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POPULAR MECHANICS

WRITTEN SO YOU CAN UNDERSTAND IT

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24 in.—26 in. Stays, 6 in. apart. Wt. per rod 7.5. **Price per rod . . . 18½c**

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16-B-510. 12 gauge, 30 or 32 in. single barrel, with ejector, **$3.70** 16 gauge single barrel, with ejector, 30 in. barrel. . **$3.70**

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Popular Mechanics

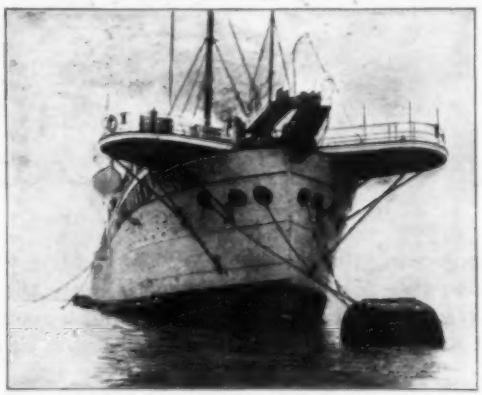
Written So You Can Understand It

Vol. 14 SEPTEMBER, 1910 No. 3

NEW TELEPHONE CABLE ACROSS ENGLISH CHANNEL

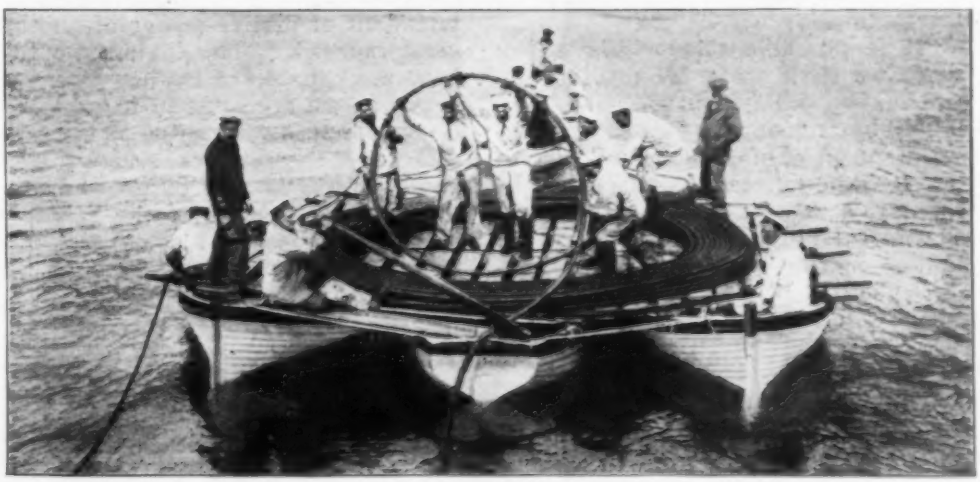
The English government has just laid a new telephone cable across the English channel which will make clear communication possible for twice the distance that has hitherto been possible with the ordinary cable. The new cable has what are called "pupin" or "loading" coils made of iron. It has been found that these, introduced at intervals in a telephone circuit, improve the speaking conditions.

Two scenes attending the laying of the cable are here illustrated. The vessel is the cable-laying ship "Faraday," which has handled more than 25,000 miles of cable, and has had as much as 2,000 miles on board at one time. The wing-like bridges extending out on each side of the bow are distinctive.



The Ship Which Laid the Cable

The other illustration shows how the cable was taken ashore. It was first wound inboard and then placed in a coil on the raft formed by three of the ship's boats. This was towed ashore, the cable being unwound and slipped into the water in the manner shown.



Paying Out Cable from a Raft

Coming—The 500-Ton Locomotive

By E. E. NORTH

A TITANIC engine weighing one million pounds, capable of drawing any load of freight cars or coaches which will stand the strain on the drawing bars.

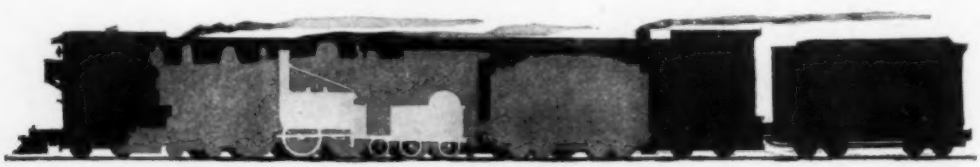
At first glance the suggestion may strike one as being absurd. But is it? Listen to this:

"It is probable that within a few years we shall see a 500-ton locomotive."

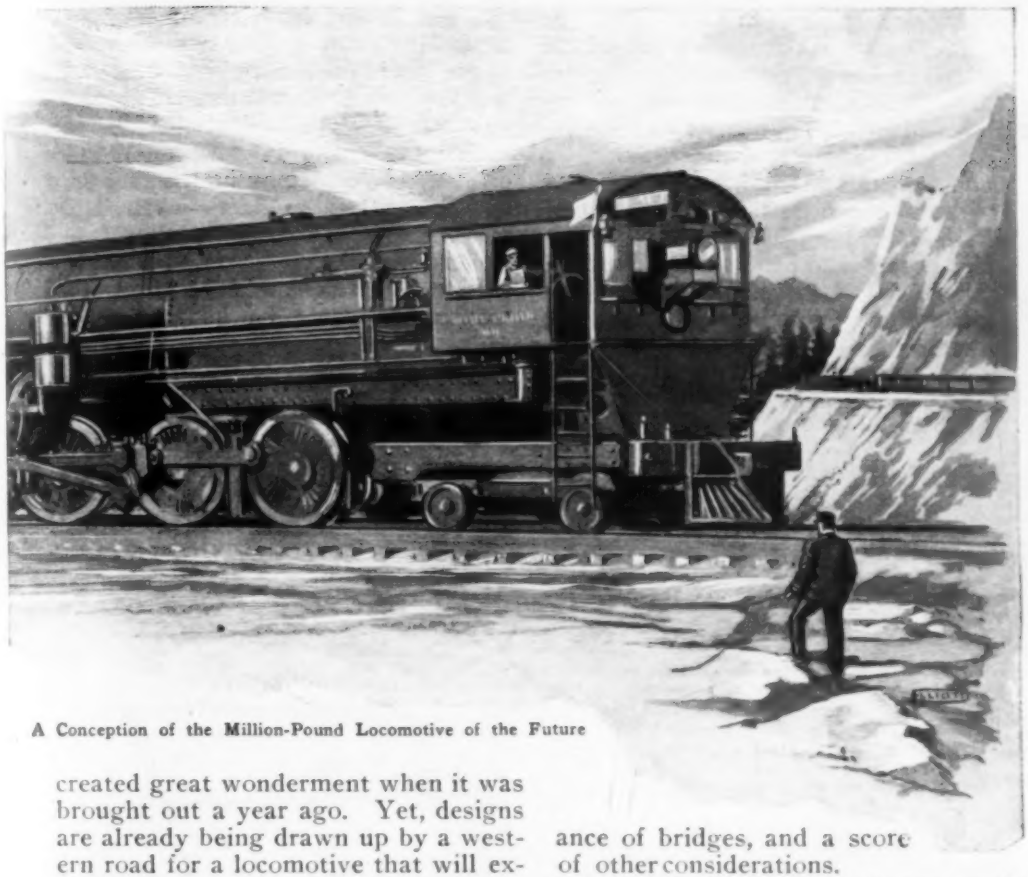
This statement was made by the superintendent of motive power of one of the largest railroad systems in the country, a man who is acknowledged as one of the highest authorities on the subject in the world. "I say probable," he added, "for I am convinced that it is more than possible."

"It would mean the expenditure of many millions of dollars to strengthen the bridges and roadbeds of our road, but I would not be surprised to see such an engine soon," says the superintendent of motive power of another great railroad. "The engines we now have are capable of hauling trains as heavy as we are allowed to take into Chicago, but in railroading as in everything else, the man who tries to set a limit will find himself outgrown."

There is in service on the Santa Fe road today a freight locomotive which weighs 462,450 lb., about 231 tons. It



The 500-Ton Titan Compared with Ordinary Large Locomotive of Today and with Stephenson's "Rocket," One of the Earliest



A Conception of the Million-Pound Locomotive of the Future

created great wonderment when it was brought out a year ago. Yet, designs are already being drawn up by a western road for a locomotive that will exceed it in weight, and a few months ago there was delivered to the Delaware and Hudson Railroad one that exerts a pressure of 441,000 lb. on the driving wheels alone. The great Santa Fe engine exerts a pressure of 412,000 lb. on the driving wheels. And it is the weight on the driving wheels that counts. One of the features of the new Delaware and Hudson locomotive is the absence of the small trucks, and the placing of the entire weight on the driving wheels. The advisability of this innovation remains to be proven.

In railroading everything depends on many other things. A locomotive must be constructed in accordance with the capabilities of the roadbed and tracks to stand the enormous weight, the strength of bridges and culverts, the height of funnels, the overhead clearance of bridges, and a score of other considerations.

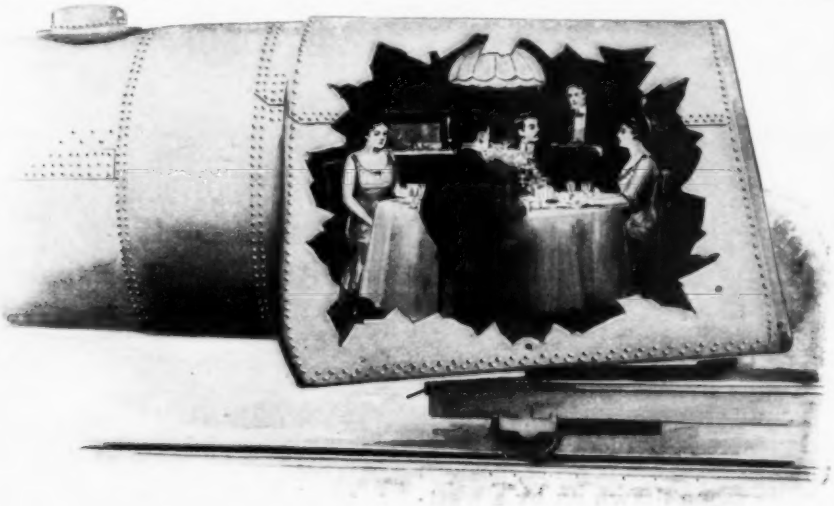
Despite the great advance made since Stephenson built his "Rocket", there are a great many characteristics of the locomotive to which the designers have adhered religiously. Some of these will undoubtedly have to be abandoned.

If the 500-ton giant is to have all the space possible for its boiler, the upper works will have to be scraped clean. The smokestack could be supplanted by a system of forced draft, but the present system of draft as applied to locomotives is extremely simple and effective and does not require a stack of any great height. The sandbox could be placed on the pilot, and the steam dome could be made very small by the use of superheated steam. The top of the cab or cabs could be leveled, and the bell, the time-honored bell which has held its place

so tenaciously through all the changes in locomotive construction, would be obliged to find a new home.

The Mallet articulated type of engine, which has reached its highest degree of perfection in the new Santa Fe locomotives, is practically two engines in one, with two distinct sets of driving wheels. Why not three?

An expert who has directed the construction of some of the largest engines in use today says that on the



Showing Immensity of Firebox of a Locomotive Weighing 500 Tons

500-ton locomotive it would be necessary to place the engineer's cab in front in order that the engineer might have an unobstructed view in rounding curves. The firebox required would have a grate surface of 175 sq. ft., large enough to serve as a garage for an automobile or as a dining room for a large family.

Yet the greatest factor to be considered in the construction of heavy locomotives today is a human one. No mechanical stoker has yet been invented which will, with any great degree of satisfaction, perform the work of the fireman. The giants of the rail have an insatiable appetite for fuel. Coal must be pushed into their maws at the rate of many tons an hour.

It might be found advisable to have two cabs, one in front for the engineer, and one behind for the firemen, provision being made so that two men could shovel coal into the firebox at the same time. Such a locomotive would consume six or seven tons of coal an hour.

The big Santa Fe locomotive uses oil fuel, and that may be the fuel used on the 500-ton monster—when it arrives.

Here geography enters as a consideration which demands attention. Obviously, it would be impractical for roads at a great distance from the source of oil supply to utilize this fuel when they have a vast supply of coal at their very doors.

Some provision would have to be made so that, should the engineer be overcome by death or sudden illness while running his engine, the train would be brought to a stop or an alarm be sounded in the firemen's cab. Electric locomotives are often provided with arrangements for this purpose, such as automatic stops which are brought into action when the hand is released from the control.

Boiler space must be enlarged with the increasing weight and size. The diameter of the boilers on the huge engine being built for the Delaware and Hudson road is a little more than 9 ft. And, although it might be urged that

the coming years may add to the efficiency of the steam engine to such an extent that this size of boiler might serve for the larger locomotive, it is not necessary to depend on this to make the million-pounder possible.

A 500-ton locomotive would be capable of overcoming a train resistance of 250,000 lb., and would haul a train of 30,000 tons, including the engine and tender, on a level track. Placing the weight of freight cars at an average of 20 tons, with an average capacity of 40 tons, a total of 60 tons, this engine would draw 490 such cars. With an average length of 40 ft., this would make a train 3½ miles long. Of course, the drawing bars would not stand such a strain, but it aids in obtaining an idea of the great power of such a monster locomotive.

The speed which could be attained by a locomotive weighing 500 tons is, of course, problematical. It is doubtful if the designers would attempt to make a record breaker of it in this respect, for it has not been shown to the satisfaction of railroad experts that any great increase of speed is advisable under present conditions.

PNEUMATIC BED BATHTUB FOR FEVER PATIENTS

The bath treatment for typhoid fever patients has been fraught with difficulties and danger on account of the peril in moving patient from the bed into the tub. An invention by a Knoxville, Tenn., physician allows the bath to be given in bed and with no more movement than rolling over the invalid. The bathtub, made of rubber, is laid on the bed and the patient moved over onto it, or else it is slipped under him. It is then inflated with a pump, the water poured in, and after the bath is finished the fluid is drawn off and the tub deflated.

Bed Bathtub in Use

Bathtub Deflated and Emptied

¶A lighted cigarette was dropped into an opening in the floor of a Kansas City store and ignited gas escaping from a tiny hole in a pipe. Just above the gas pipe was a water pipe, the lead of which was melted by the heat. This dropping lead, according to the Metal Worker, closed the hole and extinguished the fire.

The Eyes Should Not Need Rubbing

Don't Read with the Light in Front

NEW KIND OF GREEK FIRE

A German naval officer has invented a new kind of Greek fire that may be poured out on the water to block hostile ships or even for attack when conditions are such that the movement of the water will carry the fire towards the enemy. The fluid which makes the fire floats and, it is said, cannot be extinguished. Its composition is kept secret. The old Greek fire, from which it derives its name, was thrown in shells.

Your Eyes Are Your

1. When the eyes have to be rubbed frequently while reading, it is time to consult an oculist.

2. Don't read with the light in front. This ruins the eyesight quicker than anything else. The light should fall obliquely from behind over the left shoulder. Never read with the sun shining directly on your book.

3. Don't go to sleep or even take a nap in such a position that your eyes will open directly on the light when awakening.

4. When a book or magazine has to be held at arm's length in reading, it is a sign that glasses are needed. Don't delay in having your eyes tested.

5. Always hold your head erect when you read and hold your book 14 in. from your face.

6. Use a shade over every light, even a candle. Shades are cheap, or they can be easily made.

Don't Sleep Facing the Light

Most Precious Jewels

To these specific rules, which are illustrated by specially posed photographs printed herewith, should be added the following:

Be sure, when reading, that the light is clear and good.

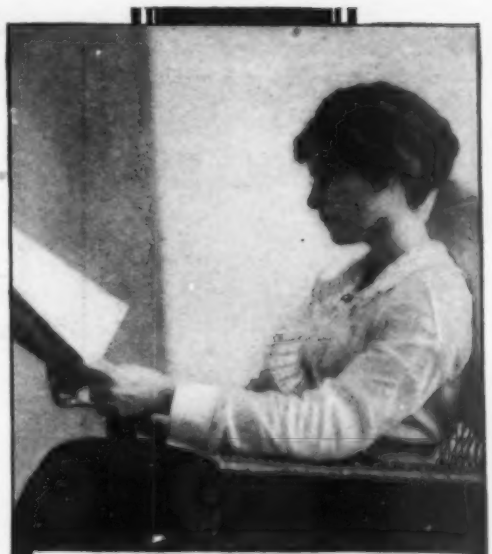
Avoid books or papers indistinctly printed or in small type.

Rest your eyes every little while, when reading, by looking away from the book.

Wash the eyes night and morning in pure water.

Educators and school officials are coming to realize the importance of safeguarding the eyesight. "Proper care of the eyes," says Ella Flagg Young, Chicago's superintendent of schools, "is one of the essentials of education." She, therefore, recommends that concise directions, embodying the ideas here stated, be printed on the front flyleaf of every school book.

Use a Shade Over Every Light

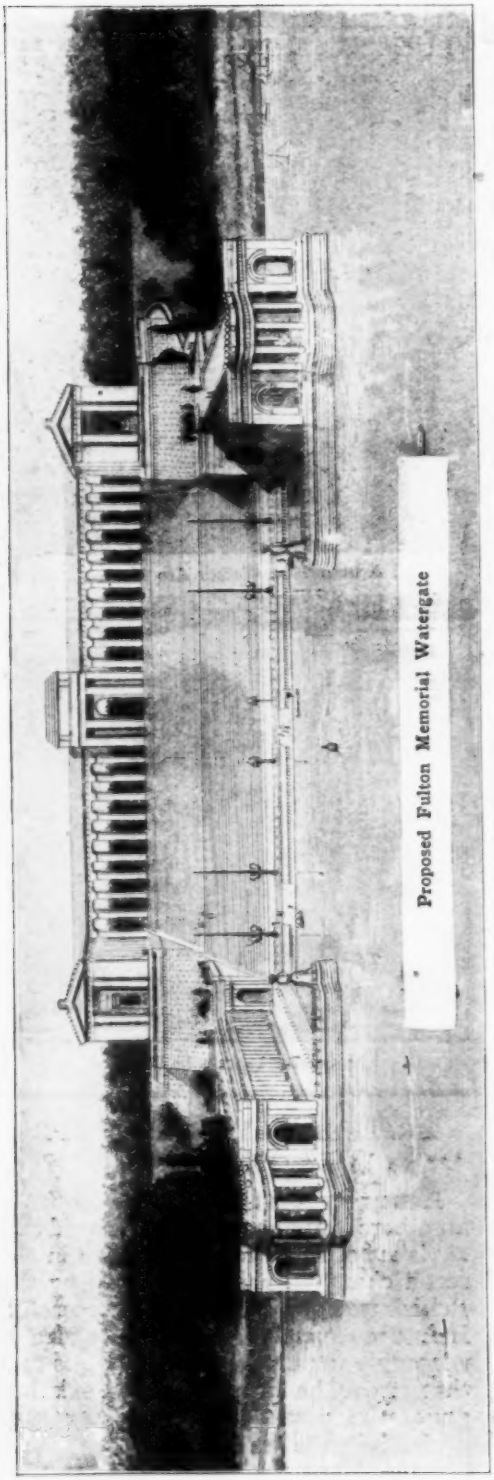


A Sign That Glasses Are Needed

The Correct Posture in Reading

BRITISH HAVE NEW TYPE OF GUN

A new type of gun, differing from all others in that a mixture of liquid and air is substituted for the springs in the recoil chamber, has been tested by the British war office and found successful. If future experiments prove the idea is adaptable for the large naval guns and that it can be fitted into the existing guns, the gun-making industry will probably enter upon a new phase of development.



Proposed Fulton Memorial Watergate

During exhaustive trials a 14.3-pound gun, fitted with the apparatus, fired ten rounds of shot in succession without relaying. So well did the liquid and air cushion bear the recoil, that the gun did not move and fired five shots with deadly precision into exactly the same hole in the target, a feat which, it is declared, has hitherto been impossible in gunnery.

NEW YORK'S PROPOSED WATERGATE

If the Robert Fulton Memorial Association can succeed in raising the $2,500,000 required, New York will have, for the reception of distinguished guests to that city from abroad, a beautiful watergate which, at the same time, will be a fitting memorial to the great steamboat pioneer.

The illustration shows the design which was awarded the first prize by the memorial association. It consists of a watergate 564 ft. long, to be erected on the Hudson river at Riverside drive, and to extend from 114th to 116th street. At the top of the bank is an open peristyle, in the center of which is shown the tomb of Robert Fulton. A building at the left end of the peristyle is for the reception of guests of the city or nation, and a similar building at the right is designated as a naval museum. A flight of 165 broad steps descend the distance of 90 ft. from the peristyle to the water. Two piers bearing colonnades project out into the river 340 ft., and form a basin 250 by 350 ft. Large vessels bearing guests will have to tie up outside or be forced to anchor in midstream, while small craft will carry the guests into the basin and up to the landing at the foot of the stairs. The flat roofs of the colonnades are laid out as promenades and recreation areas.

The intention is to build the structure largely of steel and reinforced concrete. Some parts are designed as a steel skeleton with a facing of masonry. Nearly all the money required for the project will have to be raised by popular subscription.

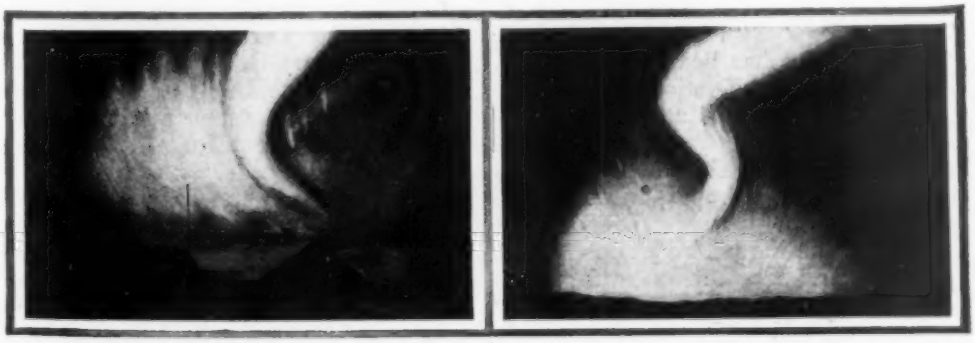
Professor Stormer and Assistant Making Snapshots of the Northern Lights

REMARKABLE AURORAL PHOTOGRAPHS

What are said to be the first really successful photographs of the aurora borealis are shown in these illustrations. They were taken by the Norwegian scientist, Professor Stormer, who led an expedition into Norway.

Until these present photographs, there existed only one good aurora borealis photograph, and that reproduced only one part of an auroral band. It was taken by a German scientist and was blurred because the aurora moved during the 7-second exposure. Professor Stormer's exposures were practically snapshots, the exposure being only a fraction of a second in most of them.

¶The applications for patents in 1909 in the United Kingdom aggregated 30,603, being the largest number but one on record.

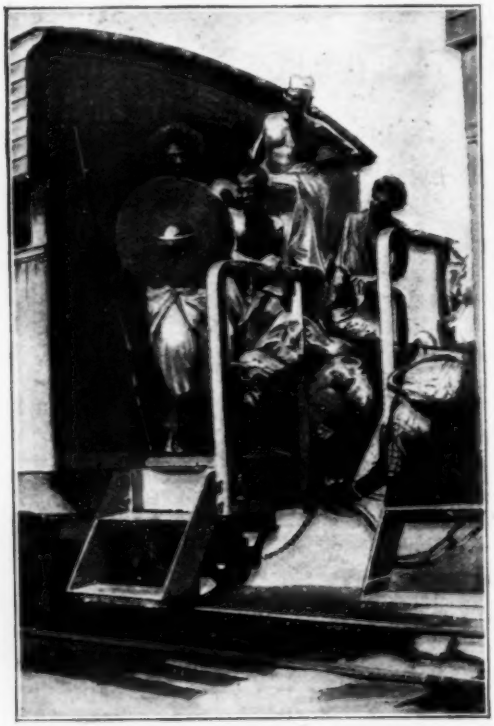


Photograph of Auroral Band

Magnificent Auroral Arc

EGYPTIAN NATIVES AND RAILWAY TRANSPORTATION

The accompanying illustration contrasts modern transportation and primitive civilization in a striking manner. The natives are a group of Hedendowas, and the train on which they are riding is on the new Port Soudan line.



Hedendowas on a New Kind of Steed

BLEACHING POWDER USED IN SWIMMING POOL

Hypochlorite has been used so successfully in the purification of the water in the swimming pool at Purdue University that there were no visible effects noticed by the bathers or by those conducting the experiment and no odor.

"The swimming pool contains 85,000 gal. of water," says Professor Burrage, who made the experiment, "and under ordinary conditions has been emptied, cleaned and refilled twice each week, at an expense of from $16 to $20 per week. Analyses of the water in the pool after it had been used gave numbers of bacteria as high as 140,000 per cubic centimeter, while the number of bacteria in the water supply taken from faucets in the same building showed between 500 and 1,000 per cubic centimeter.

"After consultation with several water experts, I concluded to try the hypochlorite and I ran a test without having the pool emptied and cleansed. The amount of hypochlorite used was at the rate of 20 lb. to 1,000,000 gal. (less than 2 lb. for the 85,000 gal.) and the total percentage of reduction of the numbers of bacteria gave 99.8 per cent. The removal of the bacillus coli, which was always present in the water after the pool had been used by bathers, was complete in every case.

"The method of applying the powder was very simple, it being thrown over the surface as evenly as possible by hand, as one walked around the pool. The powder immediately sank to the bottom, dissolving on the way. On entering the pool room the morning after the application of the chlorine of lime, there was no odor whatever noticed. Those who used the pool during the week of the test knew nothing of the experiment that was going on and there were no complaints of any kind."

QUEBEC REQUIRES DUAL LANGUAGE

A dual language law, respecting contracts with public utility companies, has just been enacted in the Province of Quebec, Canada. It provides that all passenger tickets, baggage checks, waybills, bills of lading, printed telegraph forms and contract forms, made, furnished or delivered by a railway, navigation, telegraph, telephone, transportation, express or electric power company, as well as all notices or regulations posted up in its stations, carriages, boats, offices, factories or workshops, shall be printed in both French and English.

The Army of the People

Efficiency of Organization and Character of Men in the Military Service of the United States Shown in Military Tournament on Chicago's Lake Front

By JAMES R. QUIRK

ONE million people were introduced to the khaki-clad soldiers of the regular army at Chicago last month, and two million eyes opened wide in wonderment as they gazed upon a remarkable exhibition of military life and work. As a consequence, Uncle Sam's regular army acquired a million or more of staunch supporters.

Up to within a few years it was the policy of the War Department to make the military as inconspicuous a part of our governmental organization as possible. Although the army was kept up to a high state of efficiency and liberal appropriations were made by Congress biennially, the officials directing our military policies believed in going about the work with the least possible noise. While the Kaiser was parading his glittering regiments at Potsdam for the edification of the world in general and John Bull in particular, and while all the nations of Europe were displaying the pomp and circumstance of their battalions, our War Department kept on dissecting timber and modestly avoiding the glare of publicity.

Roman Riding by Cavalrymen

This was in accord with that feeling of security which has been predominant since the days, when, having wrested independence from England, the colonies set-

tled down to enjoy peace and the fruits of peaceful enterprise under a republican form of government. Favored by geographical isolation from the bickerings of European nations, a standing army seemed unnecessary and inconsistent with the general scheme of things. There was no dynasty to uphold and protect, there were no civil dissensions to suppress, there was little danger of boundary trouble on the north. The Indian uprisings which occurred from time to time could be mastered by the local militia.

Gradually, however, the necessity of a small standing army became apparent even to the most republican of our statesmen. Consisting, at first, of but a few armed and uniformed men to guard West Point and other military stations, this nucleus was increased until in 1784 the standing army numbered about 700 men.

The idea of a huge military force which would be a drain on the nation is repulsive to Americans, and they are inclined to look with a pitying eye on the soldier-ridden nations of the continent. There are those who declare there is no need of any standing army, but they fail to realize that humanity has not yet reached that ideal stage upon which the perfect brotherhood of man may become a glorious reality.

In other countries the public is constantly in touch with the army. In some of the cities of Europe the soldiers almost equal the civilians in number. But in this country it is different. Although barracks have been located so strategically that a regiment or so could be poured into most of the large centers of population in a surprisingly short time, it has been the policy not to locate garrisons in any of the large cities. When the soldier is seen in the city, it is ten to one he is in the act of separating himself from his month's pay with that abandon for which he and the sailor are noted. The impression is left in the mind of the city dweller that the soldier is a lazy loafer, who, temperamentally opposed to labor in any form, joined the army as a means of escaping it. That impression of the American soldier may have been justified at one time, but today it is decidedly wrong. True, the enlisted man escapes some of the responsibilities of life that fall to the average lot in civil life, but, stripped of all its glamor, life in the service of Uncle Samuel is not a sinecure.

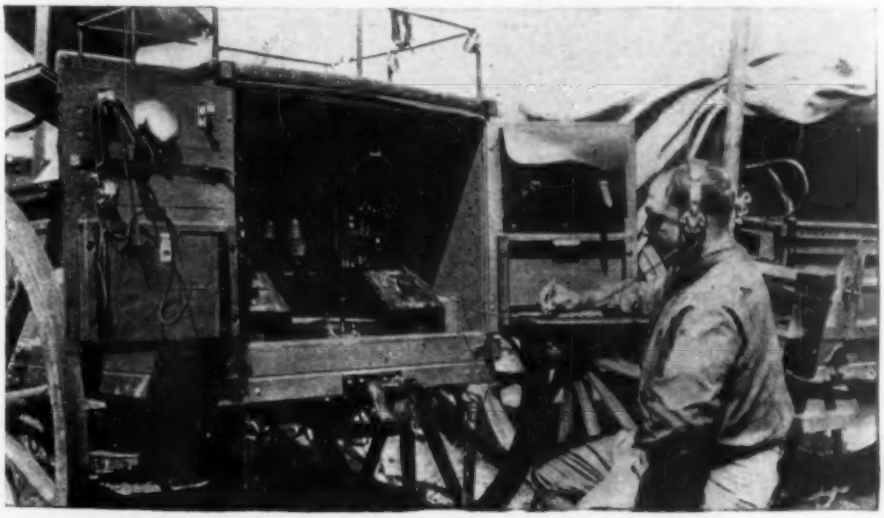
Gen. Frederick D. Grant, U. S. A.

The man in the ranks has no greater friend or supporter than Gen. Frederick Dent Grant, who, as commander of the Department of the Lakes, was in charge of the recent army tournament at Chicago. The affair was in the nature of a personal farewell to the people of that city, for at the close of the maneuvers the General proceeded to New York to command the Department of the East.

"A wrong impression as to the character of the American soldier exists in the minds of many people," said General Grant to the writer. "And it prevails to such a large extent that it

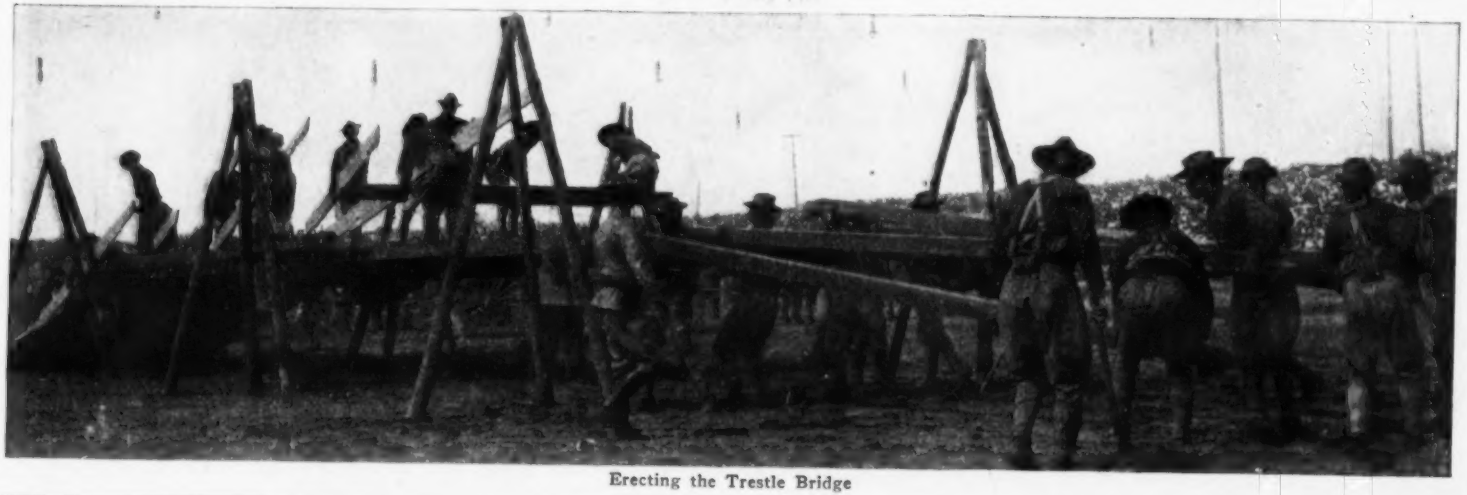
The Demolition of the Trestle Bridge with a Bomb, Baffling Pursuing Cavalry

In 50 Seconds a Battalion Broke Mass Formation and Erected Shelter Tents



Receiving Messages at the Portable Wireless Station of the Signal Corps

On the Firing Line



Erecting the Trestle Bridge

was thought advisable to show the people of the United States just what the soldier does and is. The recent practice marches attracted a great deal of attention in the communities through which the troops marched, and this led to the idea that it would be a good thing for both the army and the people to hold military tournaments in some of our large centers of population.

"Our standing army numbers about 80,000 men. Roughly, that is about 800 to every million of population, eight to every thousand. Out of every ten applications for admission to the army, one is accepted. It might be said, therefore, that the army is composed of picked men. We have, as a rule, men who are above the average in physique, and I may say, in intellect. They may not be highly educated, but they can all read and write.

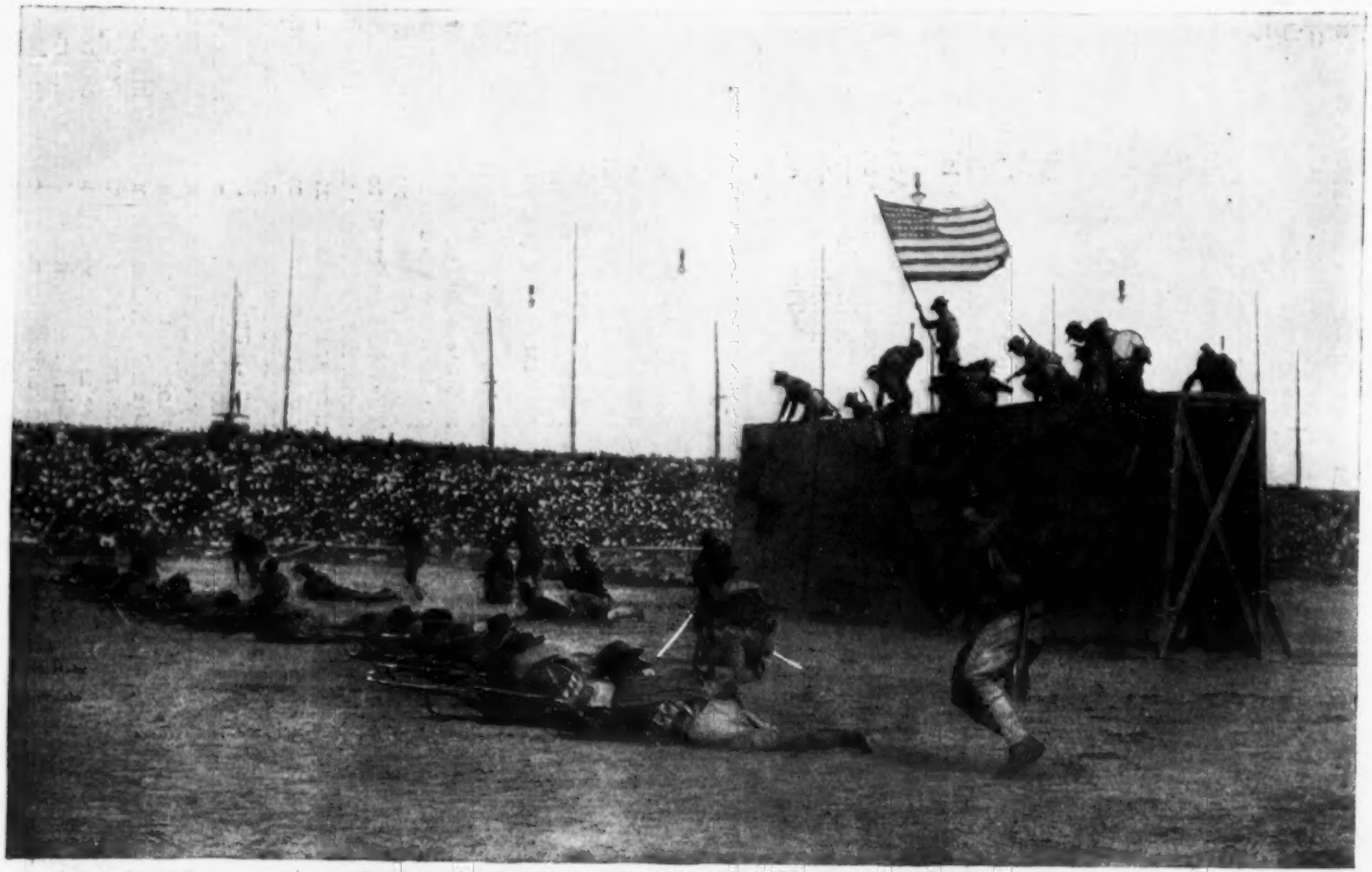
"We want the American people to realize the sort of an army they have and to appreciate it. That they do, when they are given an opportunity, was shown by the Chicago tournament. The work done on that occasion was not a series of specially staged circus stunts. It was merely a representation of the regular work done at the garrisons. Some of the more difficult riding was done by men who have served two or more years in the cavalry, but then again three-fourths of the men in one of the regiments were enlisted since April and one-half their number since June.

"I think these tournaments will awaken the people of the United States to an appreciation of the army and its importance in the affairs of the nation. The courts are generally looked upon as symbolic of the 'majesty of the law.' But the courts merely interpret the law. The real majesty of the law is the force behind it—the sword."

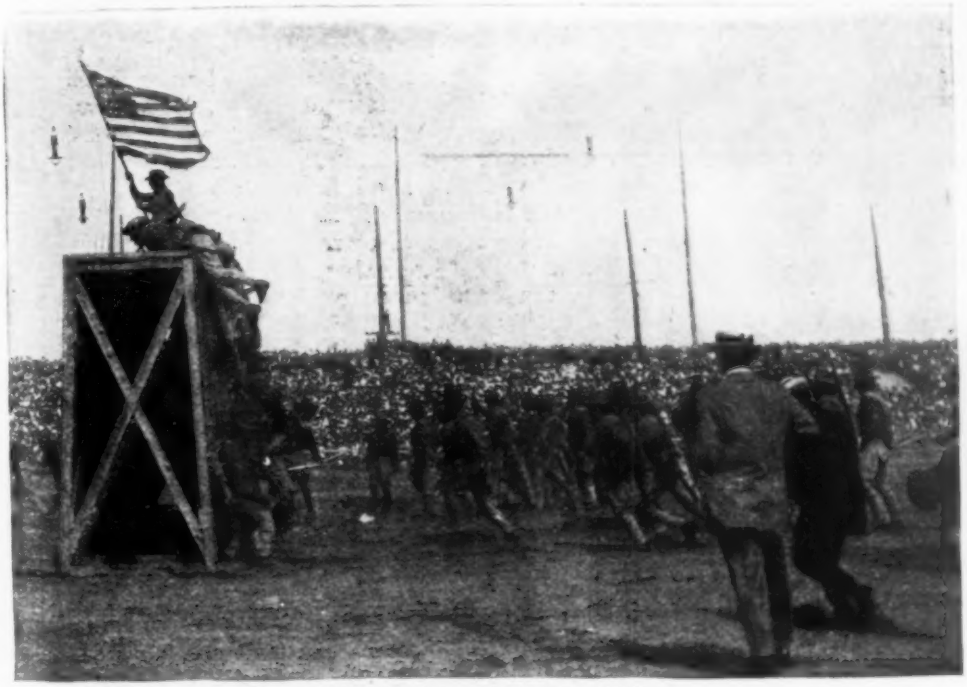
Infantry, cavalry, artillery, engineer corps, signal corps—in fact, all branches of the service were represented at the military show on the lake front of Chicago. The tournament was secured for the city by the energetic work of the Sane Fourth Association, which has been endeavoring for several years to divert the interest of the small boy, as well as his elders, from the deadly firecracker to a more rational celebration of the day. It was a strange coincidence that the park in which the encampment was made was named after the famous father of the general in command. Located in this park, too, and gazing down on the martial scenes, was the equestrian statue by St. Gaudens of General Logan, the great volunteer soldier of the Civil War.

Extending for half a mile between the skyscrapers of Michigan Avenue on one side and the lake of the same name on the other, the camp presented an inspiring sight. At one end was an immense amphitheater, 600 ft. long and 400 ft. wide, providing an open space in which a regiment could maneuver. The seats on the sides accommodated 40,000 people and most of the seats were free.

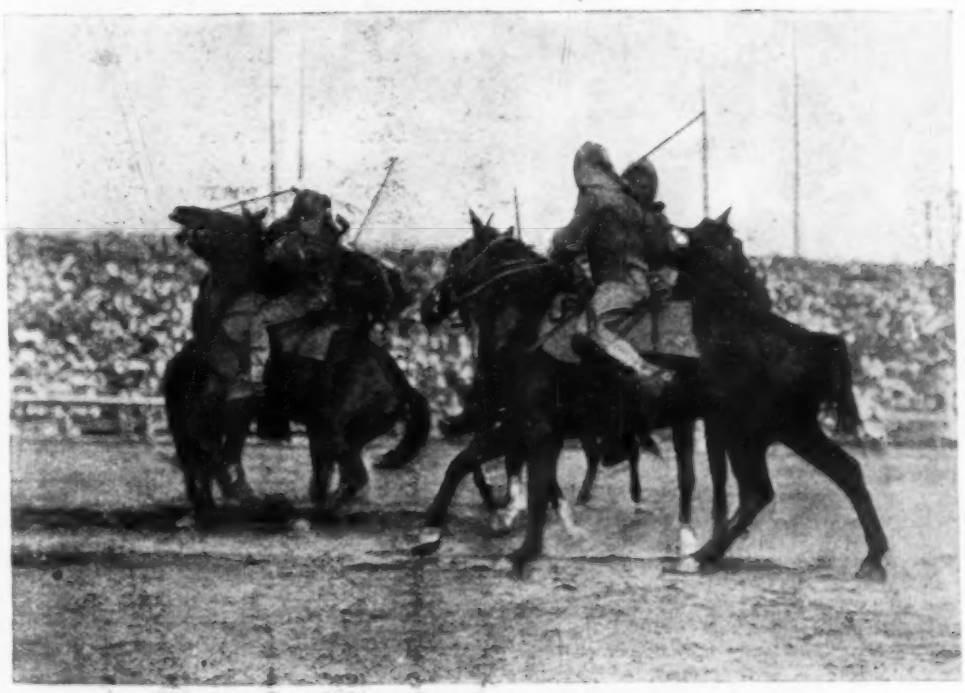
Not content with viewing the performances in the arena, the public flocked through the company streets and thus obtained an intimate view of the soldier's way of life in camp. The visitors saw the field hospitals, the portable bakeries with a capacity of thousands of loaves of bread a day, the cook-houses, the mess tents, the wireless telegraph and telephone outfits and the hundred and one things which go to make up such an encampment. To most of them it was a revelation. They had expected to see the machine guns, the Red Cross tents and the military searchlights, but who would have expected to find shower-bath tents at frequent intervals and field pieces, invented and adopted by the French only six months ago and secured and copied by our ordnance experts within such a short time? Our army behind the times? Not a bit of it. This should be modified somewhat, however, for we are lagging behind in one direction —in aeronautics. The officers are given to gloomy moods when they refer to the manner in which Congress turned down the half-million-dollar ap-



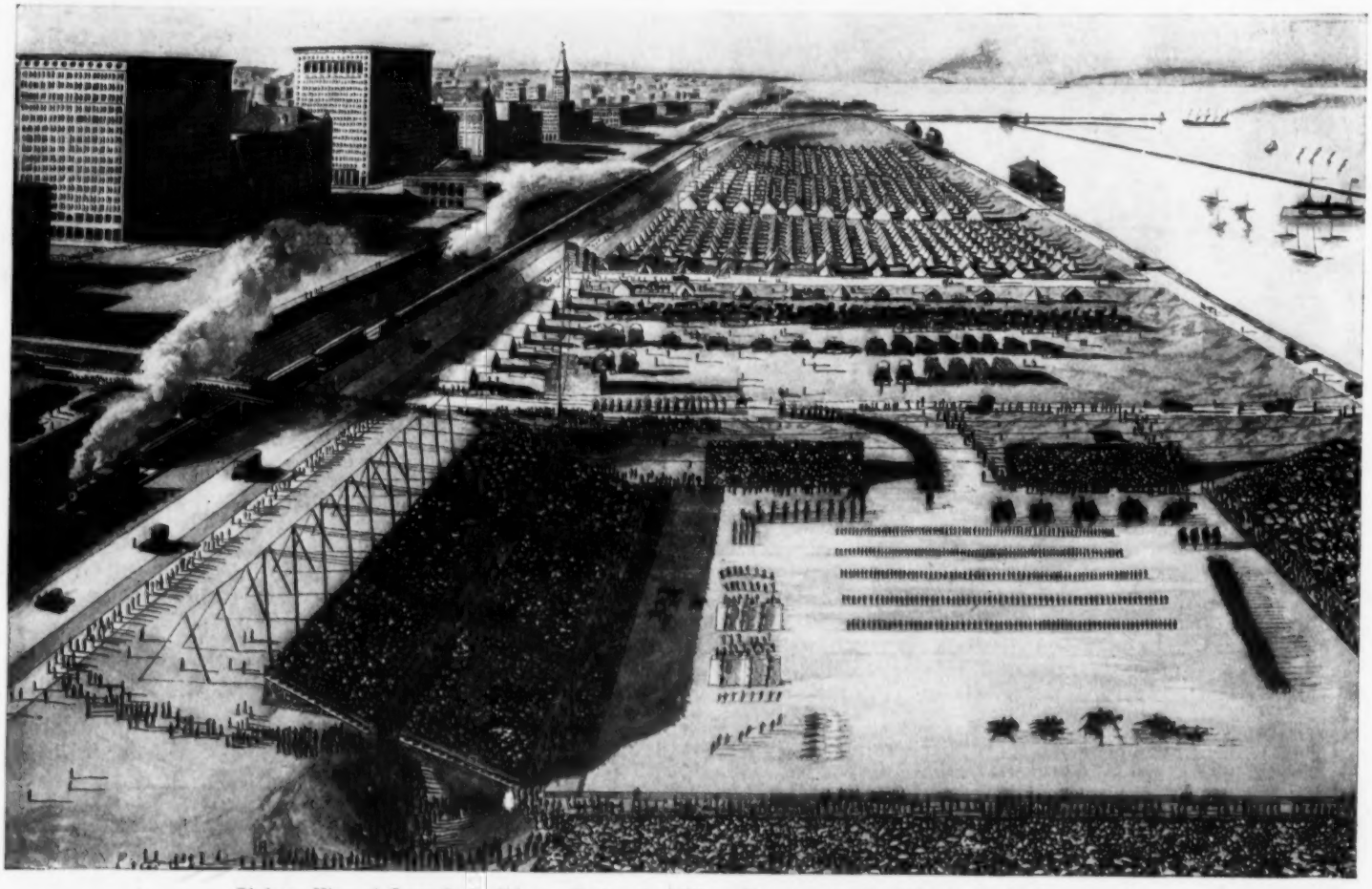
Regulars Advancing on the "Enemy" by Short Rushes After Scaling Wall



Infantry Scaling a Twelve-Foot Wall



Mounted Sabre Drill—Note Helmets and Padding to Prevent Injury



Birdseye View of Grant Park, Chicago, During the Military Tournament—Amphitheater in the Foreground

propriation for developing this branch of military activity. But they are confident that the army will not be found wanting even in this regard when need occurs.

The performances in the vast arena constituted the most comprehensive demonstration ever made in time of peace of the organization and efficiency of the army. There were no gorgeously uniformed and metal-breasted cuirassiers, no officers decked out in brilliant colors and gold braid. In action it was difficult for the civilian to distinguish a private from a colonel, for even the commanding general wore the serviceable khaki. There was little of the pomp of war. It was too scientific for pomp, too businesslike, for with that very equipment the troops would be prepared to go to the front in an hour's notice.

Some of the most spectacular work was done by the cavalry and the engineer corps, but the rapid evolutions of the artillery, the precision of the infantry, and the remarkably quick work of the signal corps, all evoked the enthusiasm of the spectators.

The construction and demolition of a trestle bridge under fire by the engineers aroused admiration. The bridge, about 100 ft. long and strong enough to bear heavily loaded, six-mule supply wagons, was thrown up in a few minutes. First, the upright supports are placed and connected by heavy timbers. A squad of the engineers takes a position some distance back to cover the men engaged in the work and protect them from the fire of the enemy. While this squad is cracking away at the supposed enemy with their Springfields, the covering is being placed over the timbers with amazing rapidity. Every man has his place and his work. One stands on the wagon, handing down lumber as fast as he can, another is posted at the end of the wagon, and others at necessary intervals, so that the piece is just handed from one man to another until it is put in its place. Every piece moves at a predetermined speed and this never varies. The covering laid, it is fastened down by rope, laced over and under the ends of the pieces, so that every piece is secured.

The fire of the enemy is becoming hotter. One detachment begins the retreat across the bridge and when over, covers the remaining troops and supply wagons. The wagons then rattle over the structure until the last detachment crosses. The cavalry of the pursuing force appears and charges the bridge. But the last infantryman has no sooner cleared the bridge than a bomb demolishes the structure, and the cavalry is baffled.

All this was accomplished in far less time than it takes to tell it. In fact the bridge was blown up just five minutes after the uprights were placed and the work of construction begun.

A feature that gave an insight into some of the hardships of the soldier on the march was the construction and breaking up of shelter camp. A battalion of the Twenty-seventh Infantry trotted onto the field and, under orders given by sharp whistles, executed a mass formation and divested itself of blankets and tents. A series of short, sharp whistles, and the mass becomes animated and confused. Within less than 50 seconds the shelter tents, one for every two men, have been erected, and the battalion has disappeared within them. Shots are heard in the distance. A sharp bugle blast arouses the apparently sleeping soldiers. Within 60 seconds the shelter tents have been taken down, and the battalion is massed in close formation to repulse an attack.

The manner in which a battalion of infantry can scale a high wall was graphically shown. Repelling the enemy's men who are posted on the wall, the troops, mounting on one another's shoulders, clamber over, and advance by short rushes. The problem of the last man is easily solved. To the lone soldier a rifle is lowered by strong hands, and he is yanked to the top and over with surprising speed.

While this sham battle was going on, a glimpse of the Red Cross in action

was presented. The ambulance corps followed close on the heels of the fighters and the instant a soldier fell, two men with a stretcher appeared and hurried him to the ambulance and to a hospital tent hastily erected in the arena.

The Sixth Cavalry presented what appeared to be an almost reckless exhibition of fencing on horseback. The helmeted and padded horsemen pummeled each other with broadswords with a violence that caused the spectators to rise to their feet with excitement. The horses kicked, reared and bucked, while the riders were compelled to manage them, maintain their seats and protect themselves from the onslaughts of their antagonists.

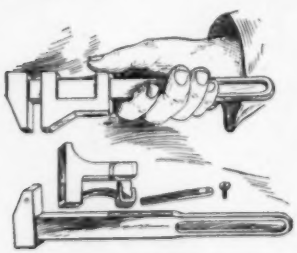
Two other events, in which the expert riding of the troops was exhibited to the best advantage, were the cavalry bareback riding and the artillery drills. After various feats of rough-riding and hurdle-jumping—feats, by the way, which would make the average circus performer envious—the cavalrymen formed themselves into companies and then climbed, pyramid fashion, on the shoulders of four horsemen. Each pyramid, mounted on four horses, then galloped around the inclosure, leaping hurdles, while the spectators held their breath in fear.

The character of the work done by the signal corps is such that it does not lend itself readily to spectacular exhibitions. Yet the showing by the corps in the big arena was readily appreciated and admired. In a remarkably short space of time the wireless wagons were dashed across the field, the pole erected, circuits established, and communication opened. The sputter of the sparks could be heard in all parts of the amphitheater. Communication was established just one minute from the time the wagons were brought to a standstill on the field. The signal corps received the reports of the prize fight at Reno on July 4th by wireless and flashed the news of the downfall of Jeffries throughout the camp.

The government at Chicago opened its new policy of bringing the public and the army together. It is willing, too, to introduce the people of other large communities to the soldiers in like manner. The result will, no doubt, be an increased pride in the country's defenders.

NEW TYPE OF ADJUSTABLE WRENCH

A wrench, that can be adjusted to take hold of different sized bolts by a simple pressure of the finger, is here illustrated. It consists of a combined upper jaw and handle, a lower or sliding jaw, an adjustment spring and a steel rack set in the lower face of the handle, the two last named devices constituting the difference between this and the ordinary wrench.



A slight pressure of the thumb at the back end of the sliding jaw depresses it against the resistance of the spring and releases its engagement with the rack. It can then be opened or closed to the desired extent, when the release of pressure on the spring causes it to again engage with the rack.

¶Sharpening the bits of 300 rock drills used in the Calumet & Hecla mines is done automatically, the only labor being to put them on a conveyor at the outset. They are heated, sharpened, upset, fluted and brought back to exact size and diameter by machines passing from one to the other mechanically.

¶Another use for aluminum has been found in combining it with gold to produce a metal that is said to possess a beautiful color, adaptable for wide use in the jewelry trade.

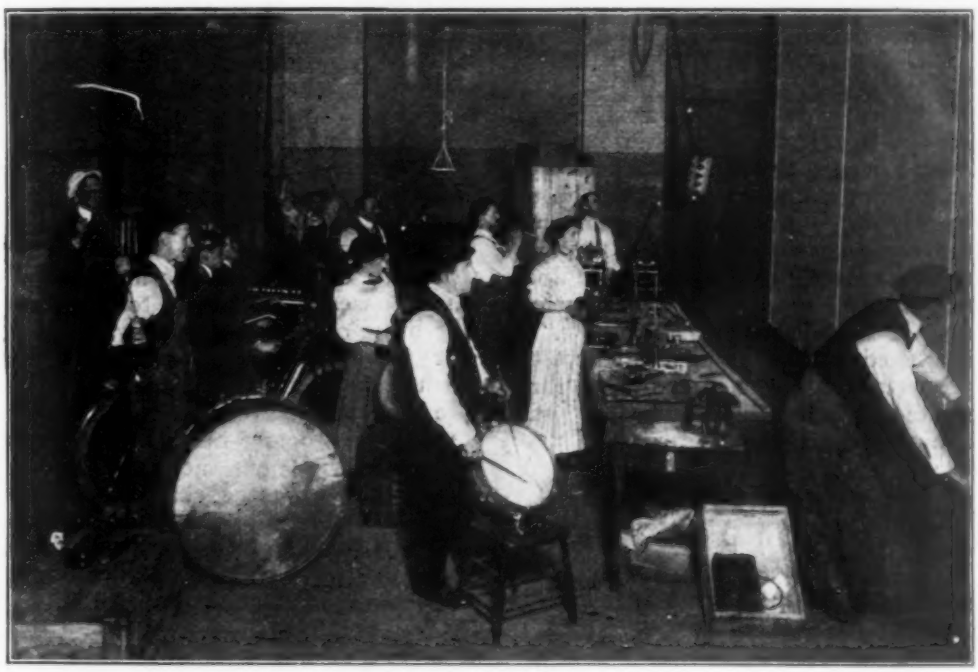
HOW THE MOVING PICTURE SPEAKS

The ordinary moving-picture exhibition is silent save for the whir of the machine, but prominent exceptions to the rule demonstrate how much more wonderful the exhibition is when every sound that accompanies the action the pictures reproduce is also given.

The manufacturing of sounds for a moving-picture show, however, is far from simple, if the sounds are to seem real. Indeed, it is quite complicated, and necessitates a troupe of trained actors as large as is required to produce many plays, although those taking the parts never appear before the audience.

Before it is possible to make the pictures speak, the most careful rehearsing has to be gone through. This is done by running the pictures slowly, with full explanations. Words, sentences, disjointed exclamations, imitations and mechanical noises are interspersed, and not until every person knows his part and can read the pictures from behind the screen is the film shown in public. For his cue, the moving-picture actor must glue his eye to the rapidly-moving views on the screen, alert to manipulate the proper sound-producing device, or speak at exactly the right moment. Should he be a moment too soon or too late, the realistic effect would be spoiled.

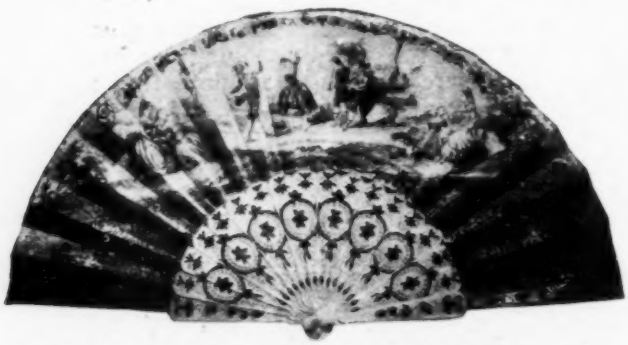
In the illustration is shown a company of moving-picture actors and the numerous sound-producing instruments provided for their use. Prominent among them are two motorcycles, the engines of which are operated when a race is being shown on the screen; an organ, to be used for its natural purpose if the screen requires, or for ingenious imitation work at other times; wind and thunder machines, bells, whistles, drums, musical tubes and irons, and many other devices ingeniously adapted to the purpose.



Making the Moving Picture Speak

A THREE-KEY LOCK

A lock-making concern in Australia is finding a ready sale for a type of lock that requires three keys to operate.



Given by Empress Eugenie to Charlotte Cushman

It is in reality three locks in one, connected in such a way that the keys must be used in the manner specified in the combination. In one lock, for instance, the three keys, numbered 1, 2 and 3, must be used in this order to unlock, and used in the reverse order to lock up. It is called a "trustees' lock," as it is used in many instances where the property secured is in charge of three trustees, each being intrusted with one of the keys.

REVOLVING AIRSHIP SHED OF STEEL AND CANVAS

The difficulty of maneuvering large dirigibles into the great sheds constructed for them has caused a German concern to construct a revolving shed for the purpose. When the airship is about to land, the shed is turned until one of the entrances is immediately in front of it. The shed has an entrance at each end, and stands on a circular platform, on which it revolves. The construction of the shed is steel skeleton work, with a canvas covering which can be rolled up when extra light is required for repairs.

Revolving Shed for Dirigibles

A FAN WITH A HISTORY

The treasure of one of the world's greatest actresses and before that, of one of the most famous queens in history, a fragile toy wrought of mother of pearl, gold and the toil of the artist's brush, the desire of every antiquarian in America—in short, the fan that the Empress Eugenie gave Charlotte Cushman, is in the possession of a Boston collector.

It is a beautiful thing, even without its associations. The sticks are of mother of pearl, inlaid with flowers of gold, while the fan itself is covered with symbols and flowers of gold and crimson, little dimmed by the years that have elapsed since the artist first laid them on.

Long ago the fan belonged to the Empress Eugenie, and formed part of the trousseau she brought to France as the bride of Napoleon. It was one of her most treasured possessions, but with characteristic generosity, when the American actress, Charlotte Cushman, played before her, delighting the empress with her acting, Eugenie plucked it from the chain about her neck and gave it to the young American. How Charlotte Cushman ever came to part with it is unknown, but, for some reason, she gave it to an understudy and later it came into the possession of a western woman, from whom the Boston collector secured it.

THE AEROPLANE AND THE BATTLESHIP

Powerful Naval Fighting Machines Will Always Determine Destinies of Nations, Unmenaced by Aerial Craft

By

CAPT. RICHMOND P. HOBSON

FLIGHT as a problem can be looked upon as solved. We are now in the second stage, that of development, and are on the eve of the third stage, that of practical application.

In all ages, the human race has dreamed of conquering the air. Other conquests have on ly intensified this, the deepest of hu man longings. The conquest of the land took ages, and the conquest of the sea yet longer ages. In both cases pro gress was slow and tedious, step by step. Ballooning has been in pro gress of develop- ment for genera tions, but flight in the aeroplane is the result of a few short years at most. In one leap, man has now made the con quest of the me- dium that envel opes both land and sea, thus making complete his proud dominion over the earth.

Capt. Richmond P. Hobson
Member of the Committee on Naval Affairs of the House of Representatives

The startling swiftness of this mighty conquest has fired the imagi- nation of the world and speculation has run wild as to its ef fect upon human life. At such times, hasty conclusions in the public mind may even lead to public policies founded upon error and leading to dis aster.

It is high time that authoritative and popular publi cations, starting from fundamental principles and following the great laws of nature from cause to effect, should get the bearings, map out the course, and point the true lines of development and the applications of the new art to activities on land and sea.

From the time when the morning stars sang together, questions of combat have had the foremost interest for man as for all living things. It is in combat of some form that individuals, types and species, of plants, animals and men have survived or perished, and are now in the process of perishing or in preparation for surviving.

The law of co-operation has been invoked primarily to enlarge the powers of combat, causing families to unite into clans, clans into tribes, tribes into nations, and nations to develop. Common defense has been the cause of and primary bond of union in every nation of the world, and will be the cause of and the primary bond of union as the nations group themselves into compact races.

It has been natural and inevitable that every new invention and discovery should be adapted instantaneously to the purposes of war. Indeed, purposes of war in offense and defense have caused the chief developments of materials and power, in quality and in size, and in application to engines and structures.

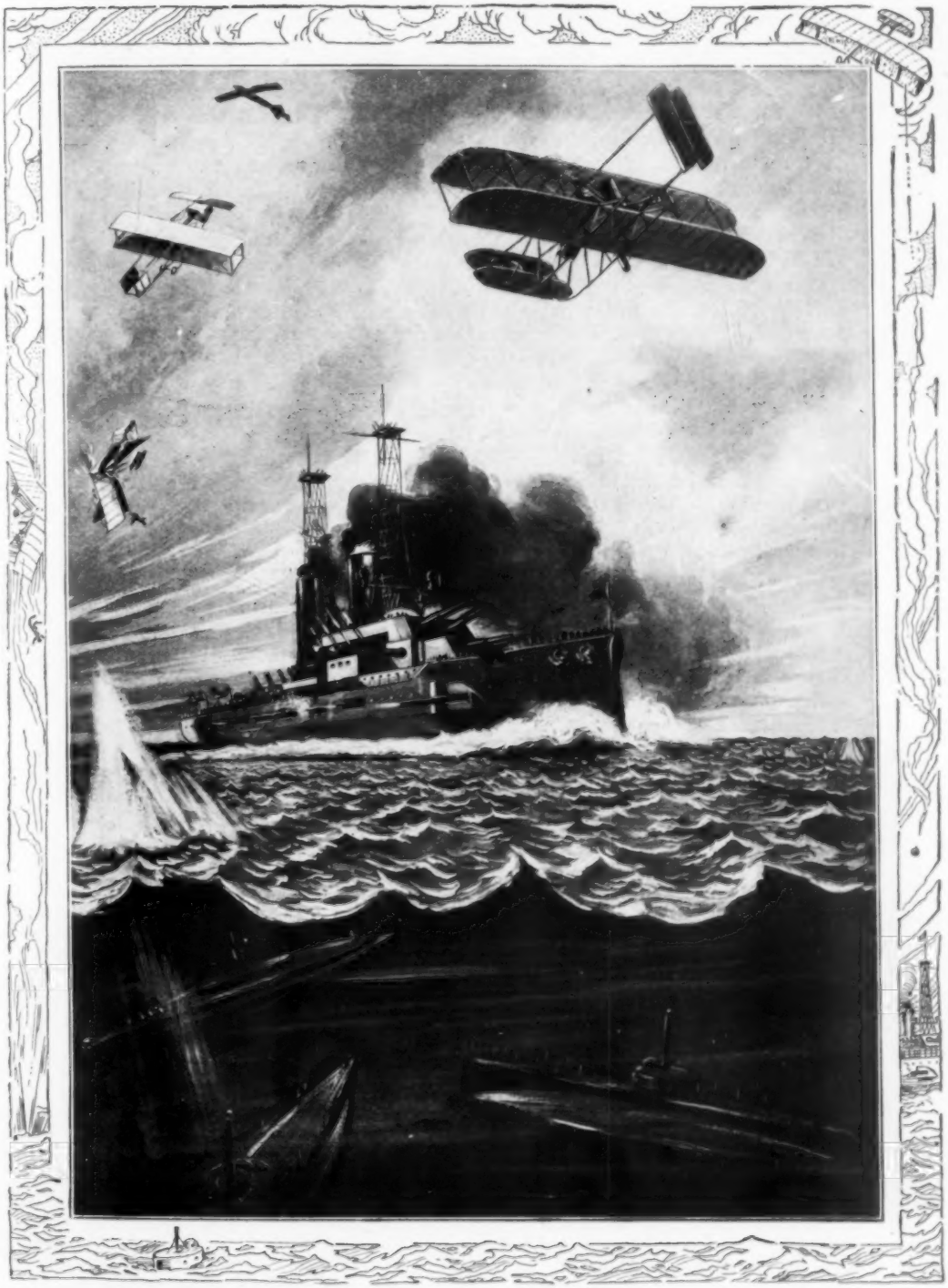
It is perfectly natural therefore, that with the sudden appearance of the aeroplane, the thought of men should turn instantly to its uses in warfare and that the popular imagination should lead to startling conclusions, particularly as to naval warfare, so fascinating and so little understood.

Great Speed Attainable in the Air is Only an Auxiliary Agency of Offense

In the popular mind, modern naval warfare is correctly typified by great battleships. One and embodied in the combines more power, of these mighty engines than did whole fleets of offensive and defensive, the cost has gone up as a few years back, and high as $12,000,000 and is still rising. It is natural that the thought of the whole world should turn to the effect of the aeroplane upon the battleship. Is it possible that one of these great costly battleships could be destroyed by one or more cheap little aeroplanes? Is the day near at hand when the aeroplane can go into combat with the battleship and have a reasonable chance to win?

The experience of nature is usually a fair guide for man. In the realm of the air, nature has evolved but one main weapon, the beak, and one auxiliary weapon, the talon. An additional main weapon, the spur, has only been evolved where the feathered creature remains upon the ground. In weapons, nature has found it impossible in the air to match the fang, claw, tusk, horn and hoof of the land, and the tooth, tentacle, fin, saw and sword of the water. The great speed attainable in the air is only an auxiliary agency of offense.

In the air, nature has undertaken no provision for defense direct. Feathers, primarily for sustaining power and for speed, are only auxiliary in defense. Nowhere do we find the special developments of hide, bone, shell and inaccessibility of vitals, found in combatants of land and water. The great speed of the air is defensive in the sum of aiding escape.



"The Aeroplane Has Come Like the Torpedo and the Submarine, but the Battleship Remains and Will Continue to Remain King"

Of forms, there is but one combatant type in the air, that of the eagle or hawk, and the maximum size is limited to a few pounds. On land and in the sea, the combatants are multiple in form and extend to tons in weight. Nowhere in the air do we find nature exhibiting the titanic combats so common between the beasts in the jungle and the great fish in the sea.

Never yet has the bird of prey been a menace to the beast of prey or the fish of prey. If actual combat took place, the outcome could be but one way. The bird could avoid combat, but choosing combat, and unable to lift the beast or fish into the air, it would of necessity be vanquished.

There must be some great principle underlying these evolutionary limitations of nature in producing combatant power in the air. It is the difficulty of sustaining any considerable weight in the air. The bulk of the activities and energies must be devoted to sustaining the bare weight involved in life itself, keeping the total weight down to a minimum, and developing the maximum energy per unit weight. Nature could find but a small margin of weight and energy available for purposes of combat. Indeed, so exacting and exhausting is the effort to sustain weight in the air, that nature has not evolved a single bird that remains permanently on the wing, nor even insects or other forms of life, animal or vegetable, capable of remaining suspended in the air and propagating their species in the air, as are found so prolifically on the land and in the sea.

When the Torpedo Was Invented, the Battleship Absorbed it as a Weapon

It is the same nature that has done its best in the air, in the sea, and on the land. It is the same man who will do his best in all three realms. He finds and will continue to find the same inherent limitations that nature found, and the presumption is that his aerial engines of combat, built under the limitations of the air, will bear about the same relations to his engines of combat on land and sea as the combatant power of birds bears to the combatant power of beast and fish. While combatant birds have a limited sphere of action against non-combatant beasts and fish, they have almost no sphere of action against combatants of land and sea.

In contrast with the limitation upon size imposed upon aeroplanes, there is not only no limit imposed upon the battleship, but there is a fundamental advantage in larger sizes both in the strategic advantage of concentration of power and in greater efficiency for each unit of weight and cost. The dead weight of the hull, broadly speaking, is like a surface, and varies with the cube of a line or dimension. The larger the vessel, the greater the proportion of total weight available for power. A single vessel of 30,000 tons can be built with the power of three vessels of 15,000 tons. Consequently, the size of the battleship has increased and will continue to increase.

It must be assumed that this expansion of size will

always enable the battleship to be built to utilize any and all new engines of war. When the torpedo was invented to be used against the battleship, the latter promptly absorbed it as one of its own weapons. When the torpedo boat was introduced, the battleship promptly put torpedo boats on its own deck and arranged for torpedo boat destroyers to be in attendance.

In comparing the aeroplane and the battleship it must be remembered that just in proportion as the aeroplane proves formidable, will the battleship provide to carry aeroplanes on its own decks and to have aeroplane destroyers in attendance. Furthermore, the size and availability of weight, will enable the battleship to be a constant, ever ready base of operations for its own aeroplanes, aeroplane destroyers, and small dirigibles and captive balloons, whereas, under the best conditions, the attacking aeroplane can operate but a short length of time away from its own base. Aeroplanes, in attack, can only make sallies and cannot follow a fleet and wait for the best conditions for attack.

The most effective work of aeroplanes will doubtless be done by those that become part of the equipment of battleships, chiefly for purposes of observation and scouting. With an understanding of these fundamental limitations imposed upon flight, whether evolved by nature or by man, we can proceed intelligently to examine the question of the attack of the aeroplane upon the battleship.

The Aeroplane Can Choose or Decline Combat, and Can Choose Altitude

The speed of battleships may now be regarded as approaching 30 miles an hour. With the increase in size, the speed will increase, but the resistance begins to absorb power more rapidly with the increase in size of the vessel. This resistance places a practical limit upon the speed of ships. No such limitation is imposed upon the speed of aeroplanes. The great speed of birds compared with speed of fish, indicates nature's relative achievements. The lifting power of an inclined plane increases with the square of the speed. It may be said roughly that there is no limit to the speed of aeroplanes and that there is decided advantage in increasing the lifting powers through increase of speed, rather than increase of size, particularly in fighting aeroplanes.

The speed of aeroplanes may be regarded as already double the speed of battleships. We must expect it to go on up to three, four, five, six times and even higher multiples. Consequently, our first conclusion is that the aeroplane can choose or decline combat; can choose its own altitude, can choose the direction of approach, and can dash through the zone of fire with astonishing speed. To meet such conditions, the battleship could have out its aeroplane scouts, and destroyers, aeroplane and dirigibles, or in cruising, its kites carried by its own speed, or carried by its torpedo boat

destroyers or other auxiliaries. It could have its dirigibles out for extended scouting and hold its aeroplanes ready for launching upon a signal of alarm. At this juncture, without reference to the question under discussion, it may be noted what wonderful scouting service aeroplanes will render fleets in their regular operations in locating the enemy's fleet, and establishing his strength, his course and formation. In this kind of work, there will be dashing achievements and thrilling races and encounters in the air, offering a tremendous incentive for skill and the development of details.

In case of a number of battleships operating together as they would do in war time, the use of all the squadron or fleet auxiliary torpedo-boat destroyers, together with special captive balloons, dirigibles and aeroplanes carried by large auxiliaries, and the fleet's flotilla of aeroplane destroyers as scouts, would not only make the chances of surprise very small, but would practically insure running the gauntlet of attack from sea and air, before the aeroplane attack could reach the battleship. To have any hope of attacking the battleships proper, the attacking aeroplanes would have to be in large numbers, dashing from all directions at the highest speed attainable.

Assume that the attacking aeroplanes were sent in droves and that goodly number bers got through, over and under the picket lines of the air and escaped destruction from the fire of the outposts of the auxiliary vessels, and dashed for the battleships—what would be the chances of battle?

Missiles of Aeroplane Must be Dropped by Gravity or Trailed and Applied Direct

The limitations of weight imposed on the aeroplane practically eliminate its use of weapons of precision other than those of the smallest caliber, small arms and automatic machine guns, which have no effect upon battleships, though they will be prominent in combat with air craft. The aeroplane's offensive power against battleships will be limited to missiles trailed and applied by direct contact, or dropped by gravity from above. An aeroplane of high speed and power could only carry a very limited number of missiles of power. It is a question whether it could carry one missile with power enough to sink a battleship even under the most favorable conditions of explosion. To apply its missile it must reach the zenith of the battleship and pass through a zone of fire extending out 10, 15 miles or beyond, from artillery of the greatest precision and power. Of course the battleship could have special ammunition of abundance adapted to this work for all big guns, up to the highest caliber. The 12-in., 13-in., 14-in. guns would hurl special shrapnel, each one of which would create a wide zone of destruction. No aeroplane could advance in the face of such a fire.

If fire opened at ten miles it would take an aeroplane going at the rate of 150 miles an hour four minutes to reach the zenith and each of even the biggest guns could make four or more

shots. Of course elevating guns and port holes would be arranged so as to permit quick, accurate elevation as high as the zenith. At the present stage of ordnance, it would be easy, not only to adapt all existing guns for aerial firing, but to make special guns for aerial defense, guns that would maintain a constant wall of shot against which the aeroplane would have to hurl itself.

Only in approaching at high altitudes could the aeroplane have any well founded hope of actually reaching the zenith. A low flight in which a missile could be trailed or dropped with any precision could only be possible on the assumption of a complete surprise, the absence of all precautions on the battleship, or an extraordinary condition of night, fog or storm, permitting the aeroplane to see the battleship while itself unseen and unheard, conditions that must be regarded as accidental. At dusk and at night the ship has the advantage of vision.

On the other hand, if the aeroplane approached at high altitudes, her offensive power would practically disappear, for with the small number of trials the chances of hitting are practically negligible, depending on the exact determination of the vertical, exact determination of the altitude, exact estimate of distances on the earth, accurate knowledge of the speed of the aeroplane, not through the air, but relatively to the earth, accurate allowance for this unknown speed, accurate allowance for the retardation of the particular form and weight of missile in passing laterally through air varying in density, accurate allowance for the deflection of unknown and variable air currents below and accurate allowance for the unknown speed of the battleship in its undetermined course, relative to the course of the aeroplane. Suppose the aeroplane were flying at the rate of 70 miles an hour or 100 ft. per second, and dropped its missile from 2,500 ft., the missile would advance 1,250 ft., more than twice the length of the largest battleship. A hit would be an accident.

Offensive Power of Aeroplane, Except Against Air Craft, Almost Negligible

Examination thus shows that in practice the offensive power of the aeroplane, except against air craft, is almost negligible as against the whole, titanic battery power of the battleship. It must be further remembered that a battleship within its own resources can avail itself of the use of aeroplane destroyers, and also captive balloons and dirigibles with developed powers of offense against aeroplanes.

The limitations of weight practically deny to aeroplanes the development of defensive power through materials of resistance, and entails a comparatively fragile construction with little recourse to the use of parts in cases of damage. Being heavier than the medium in which it travels, it becomes helpless with any serious derangement of the power to create movement. With any aeroplane, the sustained speed has comparatively narrow limits, and descent becomes necessary when the speed drops below a limit that is com-

paratively high, especially with high-powered planes built for high speeds. Furthermore, even slight derangements in the mechanism of control or in the symmetry and balance of the plane or planes necessitates descent. Any considerable repair work in the air is practically impossible. Thus the aeroplane is now and must remain a most fragile implement, without any power of defense, subject to fatal derangement by even the smallest missiles that can be hurled with precision by thousands and tens of thousands in destroying clouds from a battleship. The only defense of the aeroplane is its great speed, but even here a battleship properly equipped for the purpose, can interpose in front of it a destructive dust of missiles.

It is not necessary to detail the great defensive elements of the battleship structure, even in its present construction. It will be found difficult, if not impossible, to sink or destroy a modern battleship by a single blow, even below the waterline, except in case of the most powerful mine explosion. How can it be expected to destroy such a vessel by a single blow from the air? Of course the aeroplane's missile will be of sensitive explosive of highest power, dynamite or explosive gelatine at the present time. It could not be hoped to have such a missile pass through the superstructure and upper decks and reach the protective deck before explosion. Any claim of armor penetration is out of the question.

Battleship Can Readily Adopt New Applications of Armor and Construction

Even if it did pierce one of the protective decks, it is hardly conceivable that the ship would be destroyed by a single explosion of any missile limited by the weight an aeroplane could adopt, for the ship's vitals are in multiple units and the structure is such that damage is localized. The luckiest missile from an aeroplane would be one that missed the ship, but fell close by and exploded under water and produced a disrupting mine effect to crush in the lower under-water structure. In this way, the target for the aeroplane is increased by a wall of water around the ship. If the aeroplane drops a charge of 100 lb. of dynamite or explosive gelatine, the width of this wall may be regarded as about 20 ft., assuming that the pressure required to disrupt the structure is 5,000 lb. or more per square inch.

Already the sides and bottom compartments of battleships are built to cushion and localize the blow from torpedoes and mines, when the weight of explosion will far exceed the weight practicable in aeroplanes. Structurally the battleship embodies now great defensive power in the use of armor and arrangement of construction, expected to withstand without vital injury scores of blows as heavy as those the aeroplane can hope to strike. In addition it can readily adopt new applications of armor and construction, if needed, against missiles dropped from above. It is readily seen how wire nettings could be carried high up, at two or more heights, capable of explod-

ing if not of stopping missiles dropped from above, the lower net being designed to catch fragments. Indeed, with adaptations, special captive balloons could maintain such a net high in the air, and at the same time employ small weapons against approaching aeroplanes. It is easily seen how, in firing at the aeroplane, the missiles mounting to the zenith in large numbers would tend to explode any missile dropped with accuracy. Indeed, special guns and ammunition could be devised to keep a shower of missiles constantly ascending to cover the zenith in the same way that a cloud of missiles could be kept in front of an aeroplane.

The battleship's speed is a source of substantial protection in reducing the accuracy of missiles operated only by gravity, and this speed is easily made variable in both direction and velocity when aeroplanes are approaching. At night and in the gloaming, the searchlights from torpedo boat destroyers and other auxiliaries, sweeping the heavens and resting on the aeroplane or aeroplanes, would interfere with the latter locating battleships with lights screened, until the guns of the ships opened up with a pour of annihilation.

The limited offensive power of the aeroplane contributes almost nothing in the way of defense, while the whole battery of power of the battleship is a direct factor of defense in preventing the aeroplane from reaching the zenith. It must also be remembered that in defense, as in offense, the battleship can command the services of air craft, aeroplane destroyers, dirigibles, and captive balloons.

Projectiles of Small Size Can be Hurled Literally in Clouds from Battleships

CONCLUSIONS

1. The presumption drawn from nature is borne out by careful investigaton. Allowing for all possible developments, the inherent limitations upon the combatant power of birds will always be imposed upon aeroplanes. An eagle cannot fight a lion, neither can an aeroplane fight a battleship.

2. Having no limitation upon its size and weight a battleship can always be produced with power to utilize aeroplanes and also dirigibles and captive balloons. It is to be assumed that as a torpedo boat defense is thrown out against torpedo boat attack, air craft defense will be thrown out against aeroplane attack. The latter is the simpler for, while a torpedo can be launched with some precision from any direction, an aeroplane must reach the battleship zenith before it can drop its missile.

3. The one matchless quality of the aeroplane is speed. Future speeds will exceed anything now dreamed of. However, so many combatant necessities have to be sacrificed for this speed, that the latter, as in the case of birds, avails but little for combat except in the air. In fact, the very speed of flight entails a heavy loss of accuracy in firing or dropping missiles. Great superiority in

speed, however, does give the aeroplane the power to accept or decline combat. The probability is that this power will be used in practice chiefly to decline when a battleship's zone of fire approaches.

4. The offensive power of the aeroplane against the battleship is very small. Unable to carry weapons of precision and ammunition, its only weapon is a package of explosive propelled by gravity. To fire at all, it must reach a particular line of bearing, the zenith of the battleship. To reach this it must pass through the zone of fire. At a low altitude the defenseless aeroplane would, almost certainly, be annihilated; at a high altitude there would be very little chance of hitting the battleship, for then the error of dropping from a moving object upon a moving object is very great, nor could the aeroplane manoeuvre and make many trials to correct error, or drop a stream of shots in succession when it employs missiles of low power, incapable of inflicting serious damage.

The defensive power of the aeroplane is practically nothing. Delicate, complicated, fragile, without means of repairing damage, serious and fatal injury can be inflicted upon it by projectiles of comparatively small size, which can be hurled literally in clouds from the guns of the battleship.

Aeroplane Missile Could Not Pass First Protective Deck of Battleship

5. The offensive power of the battleship is enormous. All of its against the aeroplane is adapted to aerial firing present guns can be ed. If the offensive and special guns mount ship against the aeropowers of the battle veloped, there is no plane are carefully de doubt that they can be made literally annihilating.

The defensive power of the battleship is likewise enormous. With special fittings or equipment a battleship could explode a missile high above its decks, but even if an aeroplane did reach the zenith and drop a missile accurately, and it was not caught by a netting or exploded, having no penetrating power it could not pass the first protective deck, and its blow, under the most favorable circumstances possible, would be localized.

6. With the defensive power of the aeroplane very small against the great defensive power of the battleship, and with the offensive power of the battleship to annihilate, there can be no real combat between the two.

The aeroplane has come like the torpedo and the submarine, but the battleship remains and will continue to remain king, and will continue to grow in size and power, and will continue to determine the control of the sea and the issues of war, and the rise and fall of nations and races.

JULY AN EVENTFUL MONTH IN AERONAUTICS

As the past year has brought about some of the most remarkable developments in aviation since flying became practicable, so the month of July, 1910, must be given place in history as a record-breaking period in point of achievement as well as for the number of unfortunate accidents. Half a dozen or more records were broken, plans for long-distance flights from New York to Chicago and to St. Louis were made and eight lives were sacrificed. Independence Day was celebrated in the United States with aviation meets in a number of large cities, all of which were more or less successful. A feature of the month that has attracted attention, paradoxically, is the fact that ordinary feats of aeroplane experts no longer attract attention sufficient to make them good news items and the daily recording of flights has practically ceased, unless there is some unusual feature.

Cartoon by John T. McCutcheon, in the Chicago Tribune, on the Death of Capt. C. S. Rolls, the English Aviator

Wreck of the Aeroplane Which Fell and Killed Capt. Rolls at Bournemouth, England

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ASCENDED OVER A MILE IN AN AEROPLANE

Walter R. Brookins, although only 21 years of age, has taken a leading place among the aviators of the world. At the Atlantic City meet in July he piloted his biplane, a Wright machine, to a height of 6,175 ft., beating the record of 4,930 ft., established by him at Indianapolis. Brookins has only been actively interested in aviation for about six months. The photograph shows him just before he started the Atlantic City flight.

Some of the best known and most successful devotees of the science have paid the penalty of their devotion to aerial navigation with their lives. On July 12 Capt. Charles S. Rolls, fell when 80 ft. above ground, while conducting tests with a Wright biplane at Bournemouth, England. He had a distinguished record as an aviator, an aeronaut and a motorist. He had made a round trip across the English Channel, between Calais and Dover.

Oscar Erbsloeh and four others were killed by the explosion of the balloon "Erbsloeh" near Cologne, Germany, on July 13. The balloon fell 385 yd. with its five passengers. With Erbsloeh, who won the international balloon race at St. Louis three years ago, were Herr Toello, his financial backer, Messrs. Hett and Kronz, aeronautical engineers, and Motorman Spicke.

On July 15, Daniel Kinet, the Belgian aviator, died of injuries received a few days before in Ghent, Belgium. The rudder failed to work and he plunged to the earth. Kinet held the world's record for flight with one passenger, having remained in the air 2 hours and 51 minutes on May 15.

Charles Wachter was killed at Rheims on July 3 when he fell with an Antoinette monoplane. This aviator had made many important flights and was looked upon as a man of promise.

The most spectacular accident of the month occurred at Barcelona, Spain, where Aviator Ehrmann drove through a thunderstorm and his machine was struck by lightning. The aviator escaped uninjured, although his machine was demolished.

Baroness de la Roche was frightfully injured by a fall from her aeroplane at Rheims, but her life was saved by skillful surgeons. On July 19, the gas works of the Zeppelin Airship Company, at Friederichshafen, Germany, was demolished by an explosion, and seven persons were injured.

The better part of the record-breaking done during the month was by American flyers. Curtiss and Brookins each added to the feats of the air. Brookins surpassed all altitude records by soaring with a Wright biplane to a height of 6,175 ft. at Atlantic City on July 9. Leon Morane, a Frenchman, flew five kilometers in a Blériot in 2 minutes and 43 seconds, at Rheims, July 10. Olieslagers, a Belgian, flew 393 kilometers in 5 hours, 3 minutes and 5 seconds, also at Rheims. Curtiss made a number of spectacular flights over the ocean at Atlantic City, the first of the kind ever attempted in the United States. On one flight, Curtiss made 50 miles in 1 hour, 21 minutes and 5 seconds. Armstrong Drexel, of Philadelphia, carried a reporter of a London newspaper with him in a flight in England on July 19 and the newspaper man declared he could easily have made notes of the fortifications they passed in their route from Bournemouth to Beaulieu, a distance of 35 miles. Drexel also made the record for altitude in England, going to 1,500 ft. on July 11.

The meeting at Rheims early in the month was a most successful affair, although attended by several accidents. Aviators from all parts of Europe were present and a number of new records were set. At Budapest an attempt was made to hold an aviation meet that was not very successful, either financially or for the progress of the science.

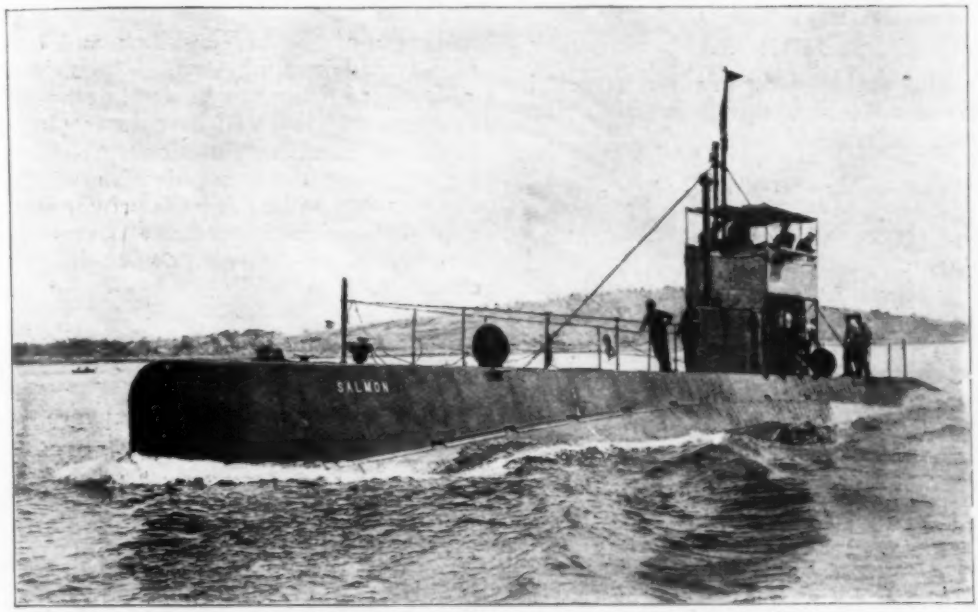
SUBMARINE DISABLES GUNBOAT

During naval maneuvers near Provincetown, Mass., in July, the submarine "Bonita," which was leading an attack on the gunboat "Castine," misjudged the distance after making a dive and, coming up at full speed, crashed against the bottom of her adversary, breaking her plates.

The "Castine" was compelled to run for the shore at full speed so as not to sink in deep water, but the "Bonita" came out of the collision practically uninjured.

¶ During the year ending June 30, 1910, 1,502 merchant vessels of 347,025 gross tons, were built in the United States.

New York City Hall as It Will Appear—Old City Hall in the Foreground



The "Salmon," Most Recent Addition to Uncle Sam's Submarine Fleet

NEW YORK'S MUNICIPAL SKYSCRAPER

New York's new municipal building, now under construction, will be one of the most remarkable structures of its kind, containing many features in both construction and architecture that differentiate it from other public edifices in any part of the world.

In the first place, its architecture is almost monumental in design, so much so, in fact, that, when viewed from the east and at a distance, it will appear more like a colossal memorial pile than like an office building. It is practically U-shaped in plan, the hollow of the U forming a court, open on one side. It is being erected near the terminus of Brooklyn Bridge, on a large plot of land lying between Park Row and Center Street.

The structure will have a frontage of 381 ft. on Center Street, and a total depth of 173 ft. The main portion will rise to a height of 337 ft. above the curbing, and will have 25 floors, while a tower, adding 15 more floors, thus making a total of 40 floors, will give the building a total height of 560 ft. above street level.

SUBMARINE "SALMON" MAKES 1600-MILE OCEAN TRIP

The U. S. S. "Salmon," Uncle Sam's newest submarine, lately completed at the Fore River shipyards at Quincy Point, Mass., is regarded as the most interesting under-water craft in the world. This distinction is due to a remarkable voyage to Bermuda and return which was successfully negotiated by the little cigar-shaped craft. This ocean voyage of 1,600 miles, which consumed 12 days and in the course of which the "Salmon" encountered considerable rough weather, has conclusively demonstrated the seaworthiness of this type of fighting craft.

The round trip to Bermuda, in making which the "Salmon" consumed upward of 6,000 gal. of gasoline, and maintained an average speed of ten knots per hour, is the longest voyage ever undertaken by a submarine of any nation.

The "Salmon," which is 135 ft. long, 14 ft. beam and 320 tons displacement, is the speediest submarine afloat, being capable of a speed of 13½ knots to 14 knots on the surface and 11½ to 12 knots submerged.

ACCIDENT TO OLD-STYLE MONORAIL

The accident on the recently built monorail line running between Bar-

Wrecked Monorail Car

tow and City Island, New York, July 16, in which several of 100 passengers were slightly injured, resulted in fear being expressed by the press of the country that the monorail system is faulty.

The monorail system having the accident, however, must not be confused with the gyroscope type of monorail evolved in the last year or two. Instead, it is a system not very much different from systems that have been tried out and found inadequate for the last 20 or 30 years.

GUN EXPLOSION KILLS ELEVEN

While battle practice was in progress at Fort Monroe, Va., on July 21, a premature explosion blew out the breech-block of one of the 12-in. guns of Battery De Russy, killing 11 men of the coast artillery, and injuring several others, including one officer. The list of deaths would have been larger, it is believed, had it not been for the heroism displayed both by officers and men, wounded included, who stamped out the burning powder and carried sacks of explosive out of the danger zone.

The explosion occurred just after the insertion of the breech-block and before it had been rotated. The safety slide of the firing mechanism, designed to prevent just such catastrophes, broke or failed to "function" properly. In attaching the lanyard with which the gun was to be fired the primer was exploded. This ignited the charge of 200 lb. of smokeless powder in the chamber.

BACK OF AVIATOR AS WRITING SUPPORT

During recent aerial maneuvers of the aeronautic corps of the French army, two of the officers made experiments with several devices designed to facilitate the work of aerial scouts in reconnoitering the position of the enemy.

The most interesting and practical of these devices are shown in the illustration. One of them is a set of trumpets by means of which the officer handling the aeroplane and the officer making a study of the position of the enemy can converse, regardless of the noise of the motor. The other is a roller holder, attached in such a position on the aviator's back that the reconnoitering officer may glance at it at any time or use it for writing purposes.

Devices of French Aerial Scouts

EDITORIAL

THE public, especially the fathers and mothers, will hail with satisfaction the first symptoms of a tendency to return to common sense methods in the public school system of a large city. Chicago is the place, and Mrs. Ella Flagg Young, Superintendent of Schools, is the daring educator who possesses sufficient nerve to take a bold stand for the sane education of children. One of her first orders was that the previous, time-honored system of requiring all pupils to write, or attempt to write, a uniform hand, be abolished. With refreshing practicality, she says, "The business man of today does not care whether the clerk writes the vertical or slant method; what is wanted is a good plain penmanship which can be read." Mrs. Young is absolutely correct, and is evidently not unacquainted with the frequent result of forcing a child to adopt a style of penmanship entirely foreign to its nature, for one's handwriting is far more individual than the shape of the nose, ears or hands. She has also declared, that, in her judgment, the ability of every boy and girl to swim is of quite as great importance as a knowledge of grammar. Hence, provision will be made at once for swimming tanks, in charge of competent instructors, first in all high schools, to which the grammar school pupils will also come, until facilities are provided in every schoolhouse in the city.

If only the school superintendents of the country could get over the practice of each attempting to out-class the others in the variety and amount of work now being done, in our grammar schools especially, and instead teach fewer things of a really practical character, and above all conserve the health of the children, which is most important of all—they would have the united approval of the public. As it is now, the work of any given grade all the way up to last year in high school has been steadily advanced and increased, until, like the present high prices of living, the burden has become almost unbearable. Educators plead they must give more advanced studies or their sixth grade will be no higher than some one else's fifth grade, apparently losing sight entirely of the fact that an overdeveloped brain at the expense of a shattered nervous system can never get very far in the world. A young man or woman, if strong, can largely make up for deficient training after they leave school, but no amount of study in middle life can supply a vigorous constitution, so absolutely essential to large accomplishment in these days. You can teach a man, but you can't supply the missing vitality that nature intended he should build up during the growing period.

One of these days our school system will be radically revised backwards, with more attention paid to producing strong, healthy bodies.

* * *

IN those cities where the Sane Fourth prevailed, and there were a large number of them, the results abundantly justified expectations. It was satisfactorily demonstrated that the new idea celebration, or rather the old idea renewed, was vastly more interesting than mere noise. In many cities, evening fireworks were confined to suitable public places, where large crowds could assemble safely and comfortably, and the firing was performed by details from the city fire department. The greatly reduced death and accident list, as compared with one year ago, leaves no excuse for the passage of necessary ordinances in those cities which have thus far hesitated to take the step.

* * *

COUNT Zeppelin, that grand old prince of the air, deserved better at the hands of fate than the accident which put his passenger ship out of commission after a few flights. The genii of the skies seem marshalled in defense of their domain; their price for victory is life and unremitting effort. In this the history of centuries of conquest on land and sea is being repeated; and as brave adventurers were never wanting to invade the home of savagery, or plunge into jungles filled with unknown dangers and fearful deaths, so these modern knights of the air will fight back, step by step, the obstacles which now guard the frontier of aviation.

To just what extent the passenger airship, now a novelty, may become a practical utility, remains to be seen. At present an airship ride is a startling fad, a thing to do because most people lack the nerve or opportunity to accomplish it. However, an air line with a capacity of twenty passengers each trip is being seriously considered, to sail between London and Paris; and while

the enterprise would involve a first cost of $250,000, there seems every promise of its being a paying venture.

The present year is making aerial history rapidly. In our own country Hamilton's flight from New York to Philadelphia and return; the flight of Curtiss from Albany to New York; the 6,000-foot altitude reached by Brookins; and the proposed and not unlikely continuous flight in October between Chicago and New York, combine to place the work of American aviators in the front rank.

* * *

FOR two weeks some three thousand soldiers of the Army, including infantry, cavalry and artillery, have been camped on the lake front in the heart of Chicago. Each week day a public demonstration was made, witnessed by a million and a half citizens, who were privileged also to walk about the camps. Of the maneuvers too much praise cannot be given, for the work was a revelation to the public. It is a pity that every citizen in our land could not have the same opportunity to acquaint himself with what our Army really is.

While the perfect work of the soldiers awoke feelings of pride and enthusiasm, the no less impressive feature was the quality of the men themselves. The American people are practically unacquainted with their Army. The streets of European cities are filled with the bright uniforms of army and navy, while in our own cities one is seldom seen, even in Washington. The result has been that the people have almost wholly failed to realize the high order of intelligence and ability which characterizes our Army.

The army tournament should be made an annual event, and held in as many of the large cities as possible, in order that the citizens may come to know, and, knowing, to respect and honor our military forces.

* * *

IN this connection it is pleasing to relate an incident during the visit of the American fleet to Australia, as told to me the other day by an American just returned from several years' residence in that country. Before the arrival of our fleet, the general expectation was that the city would be overrun with a horde of wild Indians, and preparations were made accordingly. When the fleet anchored and the men came ashore by hundreds, they proved to be gentlemen, not only the first day, but during the entire week; and the only belligerent incident was when some tipsy Australians made remarks to the native barmaids which the chivalrous Americans thought improper, and promptly knocked the offenders down. Among the lavish entertainers was the proprietor of a leading hotel. He set aside his best parlors as a club for the exclusive use of the American officers and their friends, and provided a lavish supply of the finest viands, wines and cigars for the entire week. His hospitality was accepted and his rooms constantly filled with officers of every rank; but it was the talk of the town for months when the American guests, after each having been served once, thereafter bought and paid for all they consumed. Such self-restraint was something as unheard of as it was surprising. My friend says an American is now a highly respected visitor in Australia, where before they were judged chiefly by the numerous fakirs, whose purpose was to do business on the gold brick order.

* * *

NOTWITHSTANDING the beneficial effects which many receive from a sea voyage, making the slow boats desirable for that reason, there is no doubt that the passenger steamer from this time on will be the large, fast boat. The immunity from rolling and pitching, which is scarcely noticed on a ship like the "Mauretania," where the 20,000-ton and less vessels would experience a rough passage, puts a positive premium on the big boats. Then, aside from those passengers who are naturally poor sailors, are the constantly increasing numbers who cross once or more each year on business, and to whom time and comfort are essential features. For travel, the big ship will eventually supersede the smaller ones, as fast as they are retired, although the cost in weight and fuel consumption makes it unlikely that any substantial lowering of speed is to be expected.

Before vessels of greater length than 1,000 feet can be used, there must be new docks, as present docking facilities, on both sides, have already reached their limit. A thousand-foot ship today would project 150 feet beyond any pier in New York where such a ship could lay.

H. H. WINDSOR

Remains of Coach Which Rolled Down Embankment

One of the Day Coaches in Which Nine Persons Were Killed

THE RAILROAD WRECK AT MIDDLETOWN, OHIO

Confusion in the dispatching or understanding of orders was responsible for the wreck of the Big Four Twentieth Century Limited near Middletown, Ohio, on July 4th. The passenger train collided with a freight, and resulted in the death of 23 persons and serious injuries to about 50. All that remained of the day coach, shown in the lower picture, was the floor and one side. The coach shown in the upper view rolled down a 25-foot embankment, and doubled on itself, crushing the passengers within.

H. A. Krohman, a Chemist Working Under an Endowment at the University of Kansas, Who Has Made Several Important Discoveries in Scientific Bread-Making

WELDING THE ALLIANCE BETWEEN CHEMISTRY AND INDUSTRY

By HARRY F. KOHR

THE average man little appreciates how much he owes to chemistry for the fact that the "high cost of living" that he kicks about and blames on the tariff, the gold standard or any other bugaboo isn't as high as it might be. The chemist is becoming an increasingly important factor in our daily life, and his efforts are almost wholly directed toward lowering the cost of production, either by finding more economical processes of manufacture or finding uses for products hitherto considered as waste.

To these ends many of the larger industrial enterprises employ corps of chemists with completely equipped laboratories. Possibly not one discovery of value to that particular business is made in a year or even two years, but when it is made, it is worth to that industry many times the cost of its chemical department.

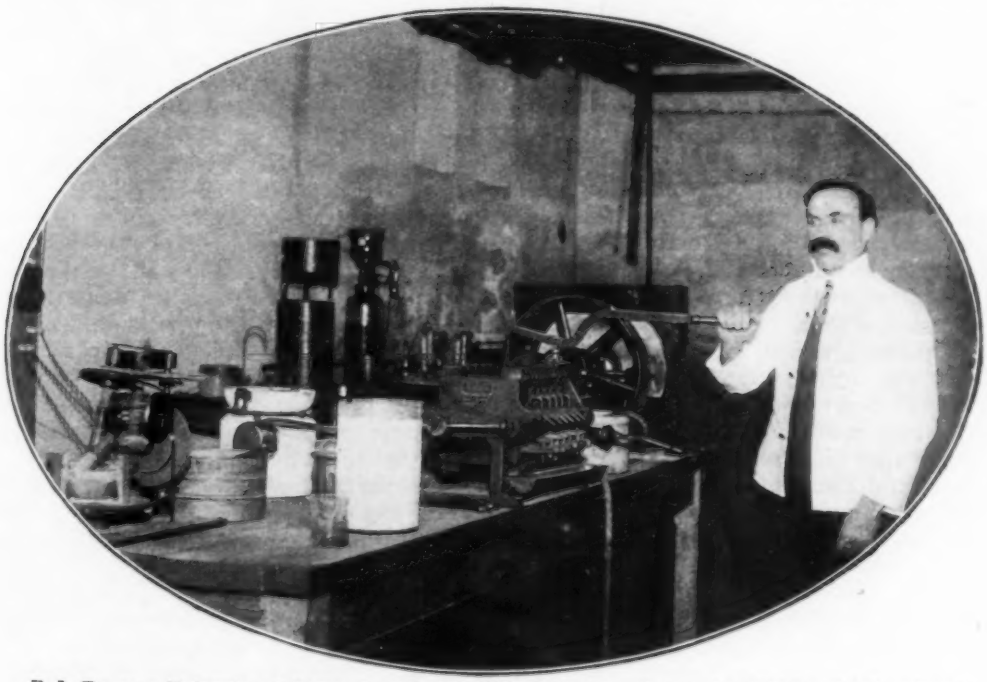
Profits in industrial enterprises in these days of close competition are largely a matter of economies, and that is where the small manufacturer is placed at a disadvantage. These economies are largely a matter of chemistry, but the cost of fitting out a laboratory and the expense of its operation is so great as to be beyond the means of the average small manufacturer. His business is suffering, perhaps, for the need of just such a department. He knows what the remedy is, but he can't afford the doctor's bill. Or, perhaps, in his business there is a large waste product. He knows there is some value in it, but he doesn't know how to get it out. If he did, perhaps, it would double his profits.

Prof. Robert Kennedy Duncan took those ideas with him when he went, three years ago, to the chemistry department of the University of Kansas.

Shortly afterwards he was discussing with a friend, a laundryman, the ideas he had formed, and the plan he had in mind to establish at the University a department of industrial chemistry for the especial purpose of helping out the small manufacturer with his chemical problems. The laundry business is one of the most highly chemicalized of all industries, yet chemistry can do many more things for it in the way of lessening wear and tear in washing, keeping saw edges off collars, lessening the time required to cleanse clothes, and such things. So Prof. Duncan's friend became the pioneer in the department and endowed a fellowship in the chemistry of laundering with $500 a year. Since then 14 other scholarships have been endowed with sums ranging from $500 to $1,500 a year for the investigation of various chemical problems. So successful has the department proved that the University of Pittsburgh has established a similar one and put Prof. Duncan at the head of it with a large increase in salary.

The rules of the industrial chemistry department of the University of Kansas allow manufacturers or others to endow a fellowship and to have the exclusive use for three years of any process which may be discovered as a result of his endowment. After that the process is made public. The fellow gets a percentage of the profits resulting from the processes he discovers and usually a permanent position with the manufacturer. The fellows, as a rule, are chosen from among the chemistry graduates who show especial aptitude.

For instance, E. L. Tague, a fellow in the department working on an endowment of $500 a year, has just perfected a process for utilizing the constituents of waste buttermilk. He has devised a process for producing casein from buttermilk, something chemists had been unable to do heretofore. At the present time, millions of gallons of buttermilk go to waste every year. Casein is largely used in the sizing of the heavier grades of paper and in solidified form for the making of brushes, combs, billiard balls and many other articles. Exhaustive tests proved the



E. L. Tague, a University of Kansas Investigator, Who Perfected a Process for Utilizing the Constituents of Waste Buttermilk and the Device for Doing the Work

worth of his discovery and now the donor of the fellowship, it is announced, is to build a million-dollar plant from which the discoverer of the process will receive ten per cent of the profits, besides incident emoluments.

At the same time an announcement was made that Archie Weith and Frank Brock, holding jointly a fellowship of $1,300, after working continuously for 18 months, had discovered a process for making an enamel for coating steel containing tanks that has the same coefficient of expansion as the metal itself, meaning that it will not crack under conditions of extreme heat or cold. It will flow over steel evenly and is resistant to acids. The discovery is of the highest value to the manufacturers of steel containing tanks and also for the manufacture of the higher grades of domestic cooking utensils. The fellowship was endowed by a manufacturer in Rochester, N. Y., and from him, in the way of royalties, the young chemists will soon be drawing as much in a month as their fellowship paid in a year.

Two years ago the National Bakers' Association endowed a fellowship paying $500 a year for an investigation into the chemistry of breadmaking. The purpose was to find a means of making bread of uniform quality, to lower, if possible, the cost of production, and to learn everything possible of value to the bakers. Henry Krohman, who was appointed to the fellowship, already has made several discoveries.

Other investigations under way include a search for a new diastase, an investigation into the constituents of crude petroleum, an investigation into the relation between the optical properties of glass and its chemical constitution, the discovery of new uses for Portland cement and of improvements in its manufacture, an attempt to discover new uses for borax, an investigation into the chemical treatment of wood, and an investigation into the possibilities for medicinal use of certain glands of deep-sea mammals.

The investigation into the chemical treatment of wood, in plainer language, is an attempt to break the Japanese monopoly of the production of camphor. The experiments are to determine if it is possible to extract camphor from the leaves and smaller branches of the camphor tree and thus make the tree a producer for years. The practice in Formosa, from which island most of the camphor comes, is to fell the tree and extract the camphor from the wood. Investigation is also to be made into the possibility of growing camphor profitably along the Gulf coast and in the West India Islands.

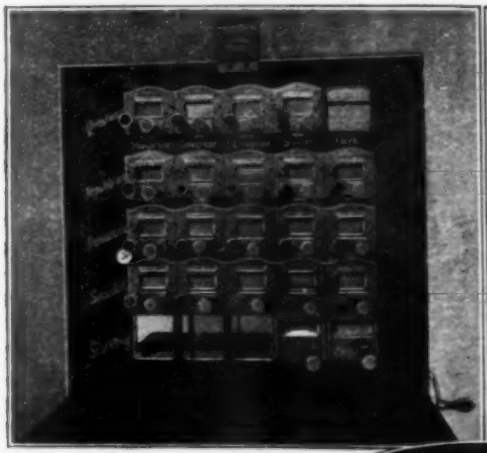
Another scholarship along the same line was founded by a furniture manufacturer for an investigation of the qualities of wood for furniture and methods of preservation.

In nearly all cases it is the desire of the donors of these fellowships that their connection with them be kept secret until their rights to discoveries are fully protected. In other cases there is no need of secrecy, because the scholarship is endowed for the benefit of the world at large. In the case of the investigation into the possibilities of the medicinal use of certain glands of deep-sea mammals, the scholarship was founded through the efforts of Dr. Grenfell, the Labrador missionary-physician, to increase, if possible, the earnings of the natives along the coast of Labrador. Their livelihood depends upon their annual catch of deep-sea mammals, such as walrus and seal. The demand for thyroid glands for medicinal use is so great that, if the glands from seals and walruses are found medicinally valuable, they will add largely to the income of the people in whom Dr. Grenfell is interested.

As yet few small manufacturers have taken advantage of great opportunities afforded them by the industrial chemistry department, largely because it has been looked upon more or less in the light of an experiment. But now, with results beginning to come from it, the University is looking upon it as one of its most important departments, and another step in the general tendency toward bringing the great universities into closer touch with industry.

AN IMPROVED VOTING MACHINE

A voting machine that is said to be absolutely accurate in every respect and by which it is impossible for a voter to cast a ballot for more than one candidate for each office, has been invented by a Californian.



The Complete Voting Machine

Interior Mechanism of Machine

Device That Registers and Counts Votes

Beginning at the top of the machine and running in horizontal rows are placed the names of the candidates, each row representing a certain party. The names are so arranged that vertical rows are formed of the candidates for each respective office. To the right of each name is placed a white button marked "yes," and to the left a black button marked "no." The black button is used only when the voter has made a mistake and wishes to cancel his ballot and vote over again. The pushing of the black button will unlock the buttons in front of the names of the other candidates for the same office which were locked by the pushing of the white button, and will cancel the first vote. The cancellation is done by a device which punches a hole through the name of the candidate voted for by mistake.

Back of the names of the candidates and their respective buttons are rolls of tape and the pushing of a white button stamps the name of the candidate it stands for upon it.

If the voter does not find the name of the person he desires to vote for on the machine, he takes a pen and writes the name on a rotary tape placed at the foot of each row of candidates. After writing the name, he presses the white button provided and this drops a metal door over the tape, making it impossible to vote again.

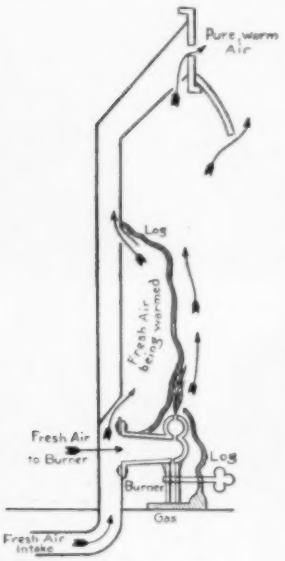
The same principle is involved in voting the straight ticket as in voting for candidates of different parties, but the pressing of the white button for the straight ticket locks every button on the board instead of merely the buttons standing for the candidates for the same office.

A feature of the machine is the fact

that each mechanism for a straight ticket and for each candidate is complete within itself, making it possible to remove any one of them on a moment's notice and replace it with another. At the closing of the polls the clerk in charge has only to unlock the rear of the machine and read the totals for each candidate from the cyclometers.

FRESH-AIR GAS GRATE

A portable gas grate, which takes its air from out of doors, instead of from the room in which it is located, is being placed on the market by a California concern. This is accomplished by means of a fresh-air intake communicating with the air out of doors, and the result is almost perfect combustion without robbing the air in the room of its oxygen.



An idea of the construction of the grate may be gained from the drawing. The waving line above the blaze designates the gas logs. Part of the air drawn in through the intake passes to the burner and comes out around the gas logs as hot air. The other part passes up inside the logs, is warmed, and passes out through a vent near the top of the grate above the logs.

¶A one-wheeled jinrikisha on the monocycle principle is being introduced among the Chinese of the Malay states. It is said to be safe and to have many advantages over the old-fashioned vehicle.

SAN FRANCISCO'S FIRE CISTERNS

An important part of San Francisco's new fire protection system is the series of 100 reinforced concrete cisterns of 7,500-gal. capacity each, built under streets and other favorable places. The cisterns are circular, 32 ft. in diameter and 16 ft. deep, and are made intercommunicating by means of 9-in. mains, also concrete. Besides, each cistern is directly connected with the regular mains.

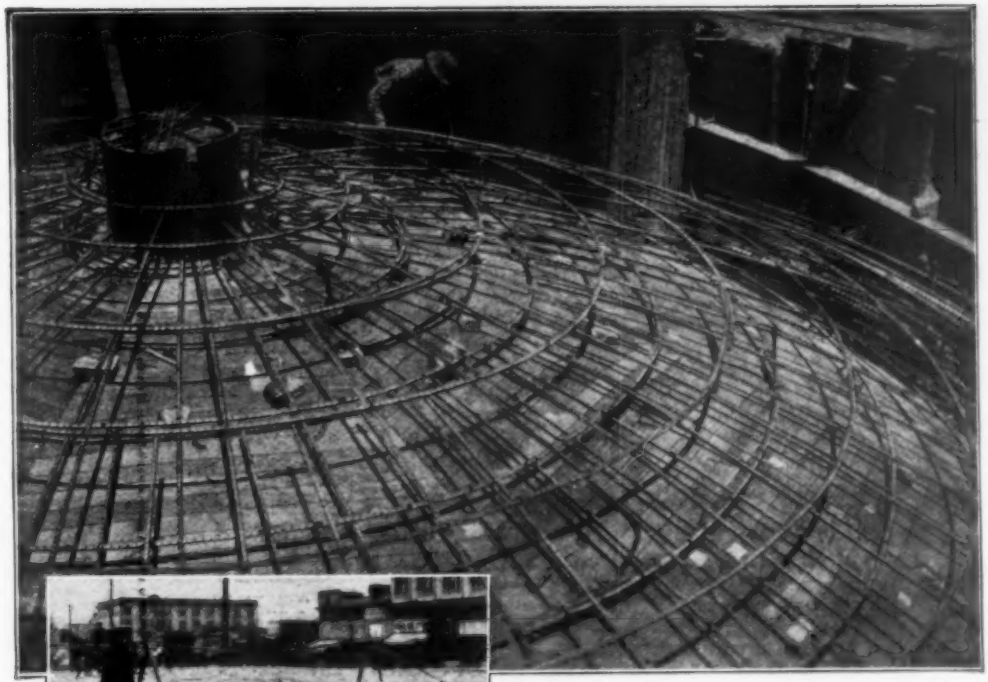
The tops of many of the cisterns, as one illustration shows, form the roadways of streets. The other illustrations show workmen pouring concrete into the forms of the side walls, and the dome shape of one of the cisterns with the steel reinforcing in place.

In the early years of San Francisco's development an emergency water supply was provided in somewhat the same manner. Reports show that in 1870 64 tanks had been built, but in the fire report of 1906 only 18 were mentioned.

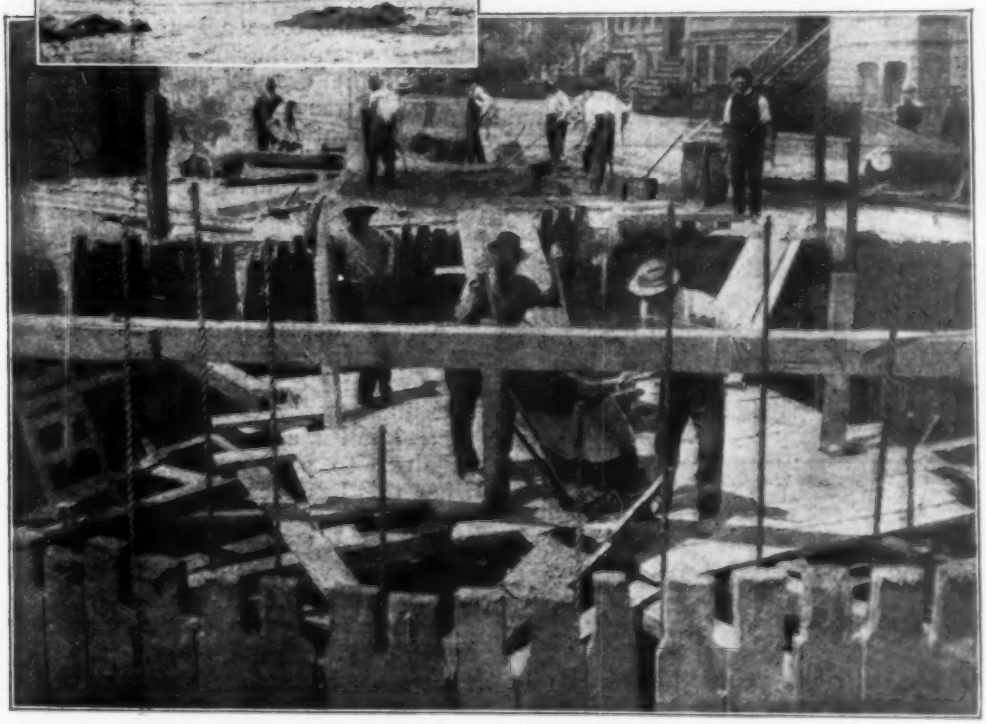
A STEAM THAWER

In Alaska it is necessary to thaw the ground before it is possible to dig, at certain seasons, and the miners have been in the habit of building fires in the bottom of their shafts in order to soften the ground. A clever device, which takes the place of the old-fashioned fire, doing the work more rapidly and effectively, is a steam thawer which sends a jet of live steam through a pipe extending down the shaft. At the lower end of this steam pipe a hollow steel point is attached. This is tapped into the ground with a hammer until work with pick and shovel is possible.

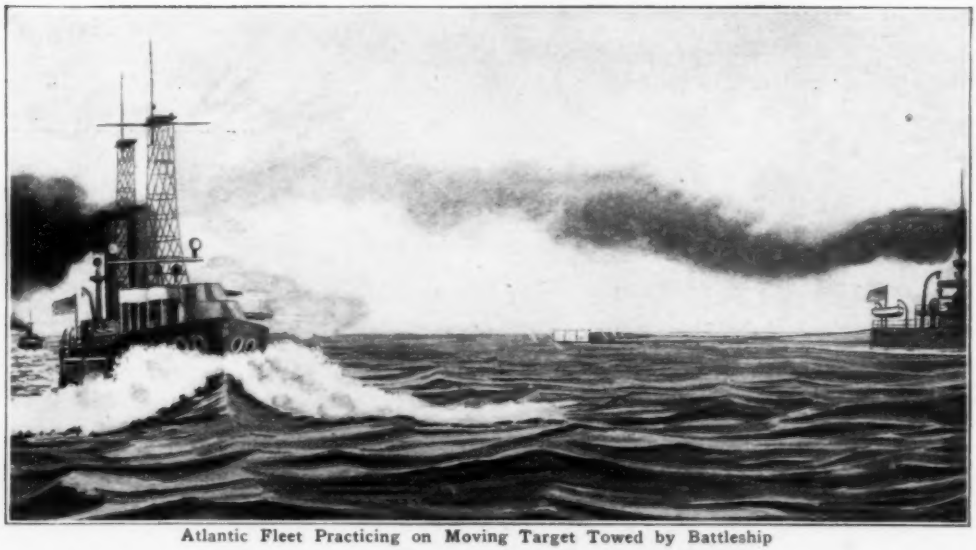
An interesting feature of this device is the use of discarded, old-fashioned rifles for that purpose. They are bought up at four or five dollars apiece and the barrels are just right for points, being of good steel, hollow, and only needing to be sharpened at one end to fit them for that purpose.



Dome-Shaped Top with Steel Reinforcing in Place



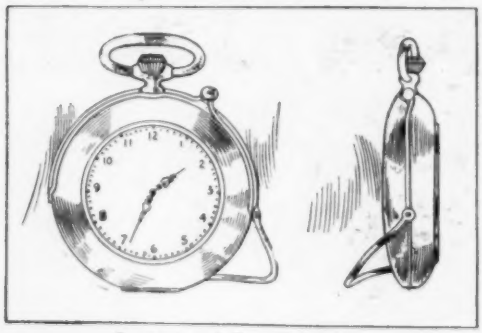
Top of Cistern Forming Part of Street—Building a Fire Cistern in San Francisco Street



Atlantic Fleet Practicing on Moving Target Towed by Battleship

WATCH PROTECTOR AND SUPPORT

In the accompanying drawings is shown a combined watch protector and support. The former is of leather and leaves the dial visible, being of a type already familiar. The metallic support attached to it, however, is something new. It pivots around the two points which fasten it to the leather sack, and



Support and Case Protector

can be so set as to constitute a support when the watch is placed upon a table or other flat surface. When not in use, the support lies closely around the watch case.

¶The American population of Manila has dropped from 5,199 to 4,174, a decrease of 1,025, or about 20 per cent.

DIVISIONAL BATTLE PRACTICE IN THE NAVY

In divisional battle practice in the U. S. Navy the fleet is formed into two divisions, the ships of each steaming in single file. The rear ships of one of the divisions tows a target on which the gunners of the "enemy" train their guns. The drawing depicts such a scene. It was made from a photograph of the Atlantic fleet engaged in battle practice. This fleet has earned high honors for marksmanship, and the practice afforded by firing at such a moving target has been a great aid.

RAIN GAUGE LIGHTENS TASK

A novel device is being used by an employe of the drainage department of the City of New Orleans to save himself unnecessary exertion. Whenever the rainfall is above the normal, he is required to start extra pumps, and when this has occurred at night, it has made a trip to the station necessary. Finding that he was often called when the rainfall was not sufficient to cause his presence at the station, he constructed a rain gauge on the roof of his home.

To a discharge pipe leading from the roof he connected a small drum reservoir, having first calculated to a nicety

the proper size. In this drum he punched a hole, so that if the rainfall is not over a certain amount, the water will run out. If it rains sufficiently hard to require the starting of extra pumps, however, the drum fills, regardless of the hole, and the weight of the water, aided by a system of balance weights, lowers it until it closes the circuit of an electric current. This rings a bell at the side of his bed.

¶A clock that plays soft music, not only to awaken a sleeper, but to put a person to sleep, thus reversing the usual function, and one that turns on the lights in a bedroom, are recent ideas in timepieces.

A COOLING SPRAY FOR HORSES IN HOT WEATHER

The Ohio Humane Society has not contented itself with establishing drinking fountains where horses may quench their thirst on hot days. Going still further, the society has provided a means for cooling the tired and heated animals with a refreshing shower bath. The photograph illustrates a scene in front of the headquarters of the society in Cincinnati. Hundreds of drivers stop there daily and take advantage of the hot weather treatment for their horses. Other fountains and sprayers are being established throughout Ohio cities by the society.

Spray Attachment with Drinking Fountains for Horses

Straw Mats Rolled Up to Admit the Sun

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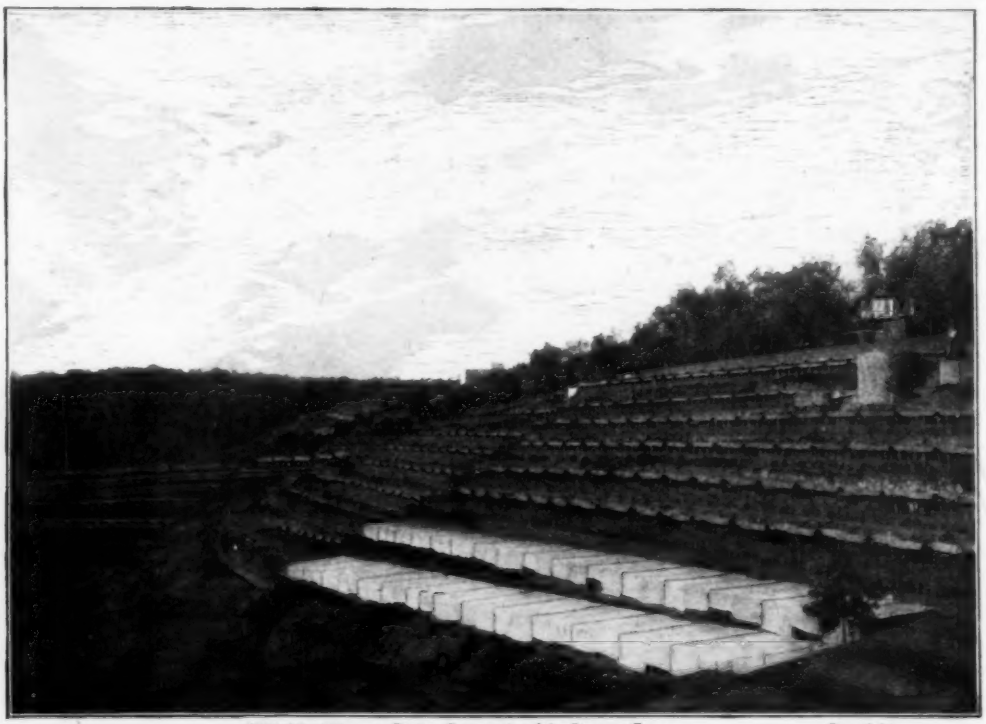

Hillside Flower Beds Covered with Straw Canopy

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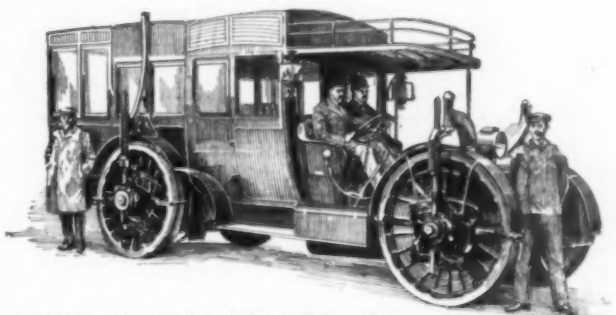
FLOWER GROWING IN THE SOUTH OF FRANCE

The climate in the south of France makes possible the growing of flowers during the winter season, during which time they are generally very rare elsewhere. In the last few years the industry has grown until in the department of Alpes Maritimes alone the annual product is worth from $3,000,000 to $4,000,000.

Near Nice there are many picturesque fields of carnations, which require protection from frosts at night. The method of protection most commonly adopted is shown in the illustrations. A light framework rises above the flowers, and upon these are straw mats, which are rolled up during the day so that the flowers may have the full benefit of the sun's rays. At night the matting is unrolled, thus forming a canopy over the flowers.

COMPOUND SUSPENSION AUTO WHEELS

The curious wheels of this heavy saloon-limousine automobile are of the compound suspension type. This suspension makes the use of pneumatic tires unnecessary. The covering of the wheels is a highly-compressed leather. The vehicle carries 23 people, and was recently presented to a Chinese military delegation in Paris. It made a journey from Brussels to Paris without accident, and demonstrated on several rather rough roads an absence of jar and vibration that was commendable.



This Mounting of Auto Wheels Makes Pneumatic Tires Unnecessary

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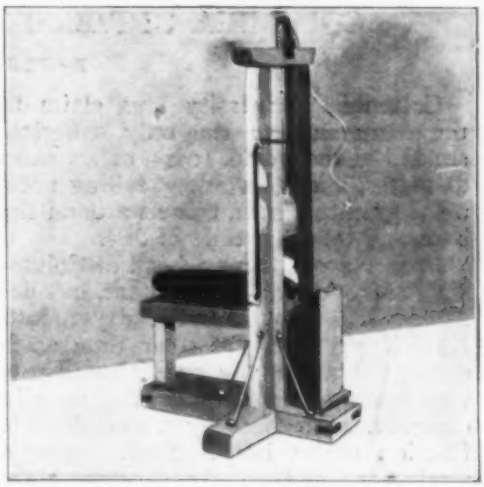
GUILLOTINE-SHAPED CIGAR-CUTTER

A curiously shaped and operated cigar-cutter is shown in this illustration. It is an exact reproduction in miniature of the famous guillotine of the French revolution, and will have to cut off the ends of many cigars before it equals the horrible record in heads of the instrument of which it is a copy.



Cigar-Cutter Copied After Guillotine

The knife of the cigar-guillotine is raised by pulling on the string, and falls when the string is released.

¶A compilation of the comparative risks in different trades made by the German Government does not agree with the opinion which has been prevalent that the miner is more exposed to danger than the worker in any other occupation. From the German report it would seem that the carters and drivers follow the most hazardous occupation; next in order being quarrymen, canal and river boat-men, miners, tunnel workers, wood workers and iron and steel workers.

COLUMBIA UNIVERSITY'S SPHERICAL SUNDIAL

By FOSTER WARE

Columbia University lays claim to the ownership of the only spherical sundial in the world. It is a ball, 7 ft. in diameter, and its shadow, falling upon a flat granite plinth, travels around the base and tells the time of day.

Prof. Harold Jacoby, head of Columbia's astronomical department, has designed it so as to indicate standard New York time, not solar time as is ordinarily shown by sundials. These two kinds of time, of course, usually disagree, sometimes by a considerable fraction of an hour. Prof. Jacoby's work consisted chiefly of calculating the angle of the ball's shadow at noon for every day in the year.

With the sun shining, the big sphere casts an elliptical shadow, which travels around the base as the hours pass. It would be possible, of course, to add to the number of hour marks so that the dial would indicate time all day long, and this may be done when the necessary calculations have been completed. For the present, however, a series of 12 concentric circles—one for each month in the year—have been engraved upon a bronze plate inlaid on the surface of the base.

On each line are marks numbered to represent each day in the month. When the shadow intercepts a given line at one of these marks, it will be 12 o'clock noon of that particular day. The position of the shadow at noon is different every day of the year, so that it will touch a given mark—say August 1—only once a year at noon.

Prof. Jacoby has calculated the angles astronomically and believes that the dial will mark the noon hour to the exactness of a fraction of a minute. It is his opinion that, as the dial is more of an ornament and a curiosity than anything else, it will attract more attention and create more interest than a complete dial because the transit of the shadow each day at noon will bring together a considerable number of students and others to watch the phenomenon.

The dial was recently presented to the university by the class of 1885, of which Prof. Jacoby is a member, as its quarter-centennial gift. It was erected at a cost of $10,000, and occupies a prominent place on the Columbia campus. The ball, which is made of polished green Ascutney granite, rests upon a broad flat granite base of neutral color. This base is 24 sided, and is decorated with inlaid bronze ornaments, designed by the firm of McKim, Mead & White, architects of the Columbia campus buildings. Many of the ornaments are taken from the signs of the Zodiac.

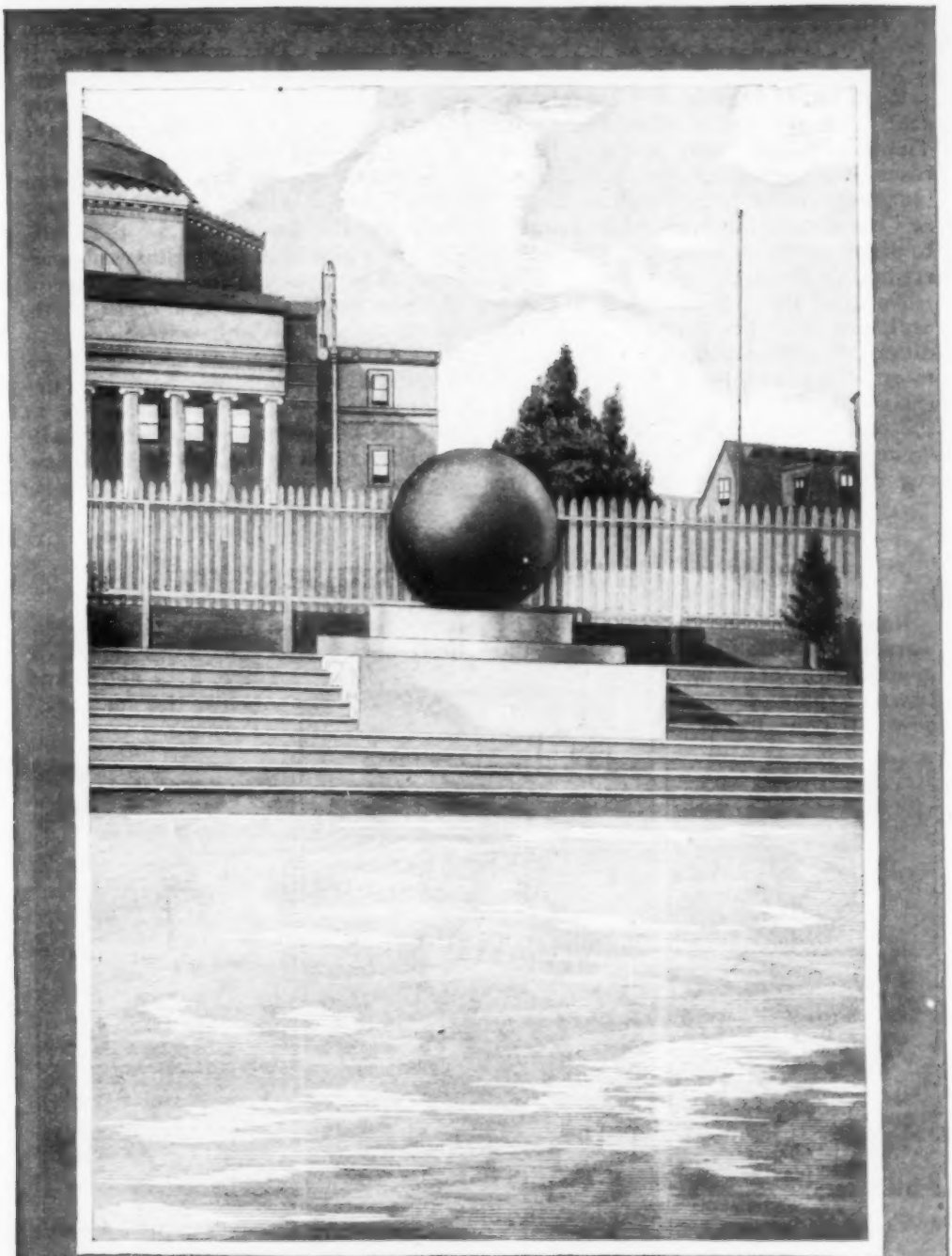
CATCHING FISH BY POISONING

Fishing with poisons is practiced by primitive peoples in many different parts of the world, but in all cases the methods have a common resemblance in that they all involve the temporary stupefying of the fish.

The poison consists of the juices of crushed plants, different kinds being used in different countries. The plant, of whatever species is available, is gathered and crushed in great quantities, the gathering and preparing requiring the combined efforts of many persons. Whenever a fish-poisoning occurs, it is the occasion of a general picnic, with feasting, the wearing of flowers, and much jollity. This is especially so in the South Sea Islands.

When the tide recedes from the reefs, many deep pools remain, filled with fishes of many kinds. The poison is placed in these pools and later the fish come to the surface in such distress that they can easily be picked up. Fish coming in across the reefs with the rising tide are also affected by the poison and are easily secured.

Although the juices used are poisonous to the human stomach, there is said to be no unwholesomeness attached to the eating of the fish so captured.



HANDSOME SUNDIAL WHICH GIVES STANDARD TIME

ARTIFICIALLY COLORED TUBEROSES

Reports received in this country recently to the effect that florists of Tientsin, China, were growing tuberoses of a red color has resulted in an investigation by S. S. Knabenshue, U. S. Consul-General, which has brought to light a very interesting means of artificial coloring.

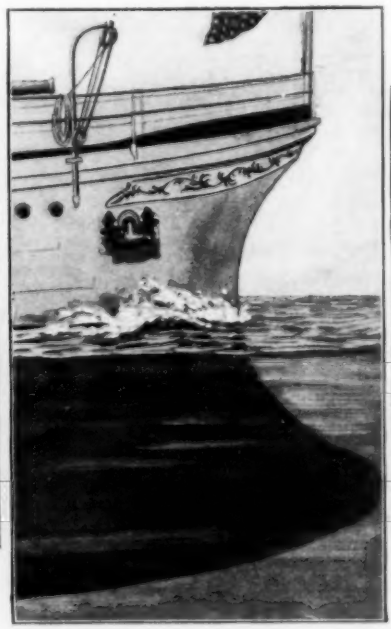
None of the red tuberoses are natural, the color being obtained by two different methods, both of which are more or less simple. The first method is as follows: When the tuberose of the ordinary white variety is near the flowering stage, the flower stalks are cut off close to the ground and are placed in water in which is dissolved a red earth. This coloring matter is drawn up into the flowers, tinting them red, the first that appear being slightly tinged, while those opening later have a more pronounced color.

In the second method the bulbs themselves are doctored. Incisions are made in the lower half of the bulb, then it is placed in the ordinary flowerpot. The opening in the bottom of the pot is closed with a cork; earth, mixed to a mud with water in which the coloring matter has been dissolved, is placed in the lower part and uncolored earth is placed above this to hide the coloring matter. The resulting flowers have the tint of the coloring used.

NEW TYPE OF BRITISH CRUISER BOWS

Rams as powerful as any carried by warships of past days are to form the lower part of the bows of some of the new British third-class cruisers, while that portion above water will be concave and graceful in appearance, belying the formidable character of what is hidden by the water. The illustrations show what the bows will look like, both above and below the surface of the sea.

Appearance of a Warship's Ram



Combination of Ram and Concave Bow

Concave Bows of New British Cruisers

The ram of a battleship is an effective weapon for use in running down an attacking fleet of torpedo boats.

THE MAKING OF ARTS-CRAFTS LAMPS

By JOHN D. ADAMS

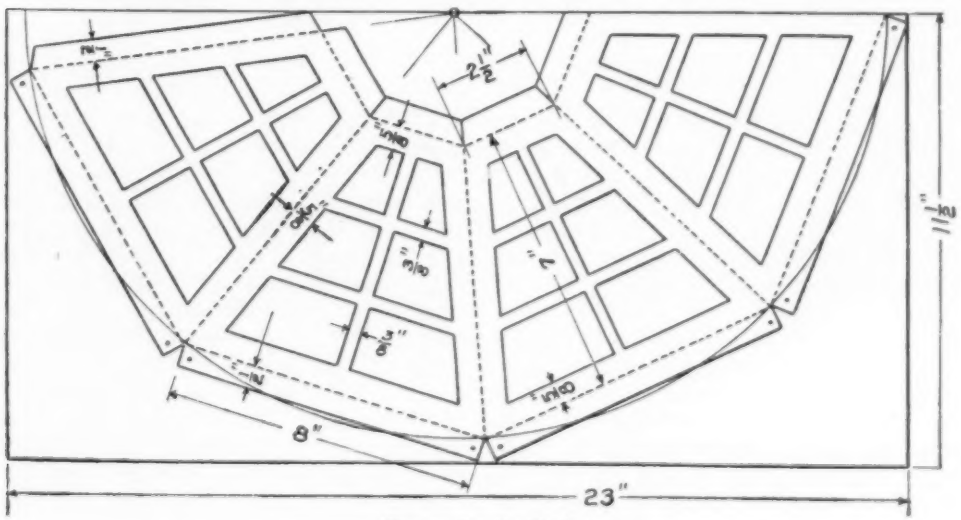
Part II

TWO-LIGHT PORTABLE LAMP

IN this two-light portable lamp we have an excellent design for the center of the library table. The shades are deep and the lamp is hung well up, so that anyone writing, drawing, or doing any sort of work requiring the use of a table, will find that the light is thrown just where it is required, while the eyes are completely shaded. The shades are of a much used pattern, and those that do not care to undertake the construction of the stand will find them very useful in hiding the common unshaded and glaring drop lights, so harmful to the eyes.

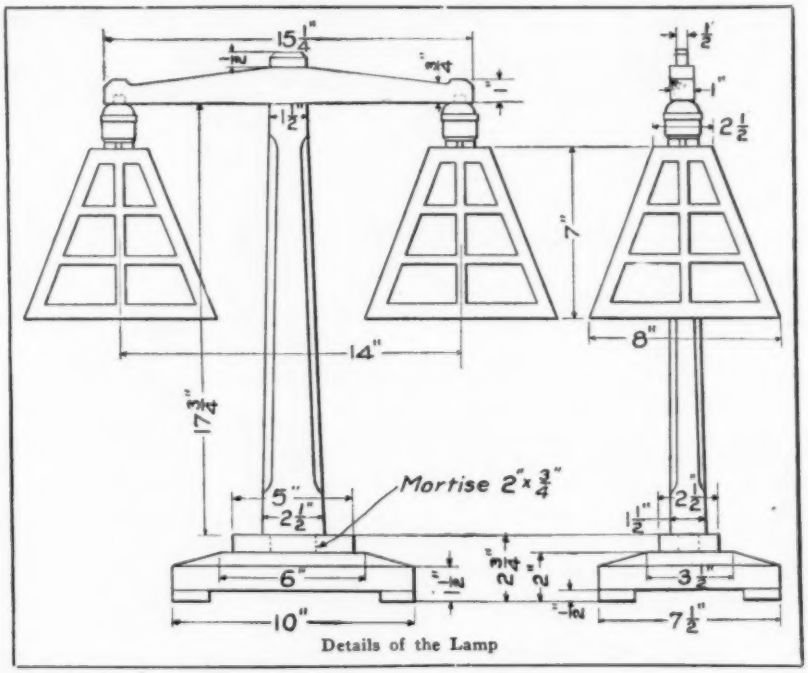
Attractive Two-Light Library Table Lamp

The shades are constructed in the same general manner as the one described in the previous chapter. Procure a piece of tough cardboard about 12 by 24 in. Lay out the pattern for one side with a sharp pencil on a piece of thick paper, and then cut it out with a sharp knife. Apply the paper pattern to the cardboard and mark it off, then move it one space and mark off



Pattern for the Shades

again, continuing the operation until all four sides are drawn out as shown. It will be noted that the last edge has an extra strip, which is for the purpose of connecting the first and last sections together. There are also extra strips along the top and bottom of each section. The dotted lines indicate those that are to be merely scored with the knife for bending, and the full lines are those that are to be cut clear through. When ready to bend into shape, place the line of each bend over the sharp edge of a table, hold the portion on the table down with a piece of wood, and then gradually bend along the entire line. The two ends may be fastened with paper fasteners or by glue, in which case means should be provided to keep the connection tight for an hour or so until set. Bind the corner edges of all bends with passepartout tape. The extra strips on the lower edges should now be bent inward and connected at the overlapping corners with paper fasteners. The extra strips at the top are then to be bent inward and fastened to a square of cardboard closely fitted into the top from underneath. In the center of this square cut a hole 1⅝ in. in diameter, and near each corner push the knife blade clear through. Cut out four strips of tin, measuring ¼ by 1½ in., and fasten them to the top through the slits made with the knife, in the manner shown in the detail view. All this is for the purpose of connecting the shade to the existing socket, which should now be placed in position and

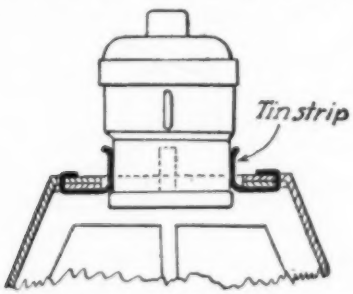


Details of the Lamp

the four strips of tin fitted closely around it, and when the shade is ready to be hung up for good, bind tightly with a piece of light cord. It only remains now to place the colored paper on the inside. As the effect when illuminated cannot be judged by daylight, the paper should be tried after dark, and if it proves too light use two or more thicknesses.

Start the construction of the stand with the base, which, after having been trimmed off squarely and bevelled on top, should be fitted on the under side with a little block at each corner. The second base block should now be

squared up and an oblong mortise cut for the end of the center post. Glue this block in position, and then proceed with the cross bar at the top. Shape this up to size, and then cut an oblong mortise in the center, after which the center post should be prepared. After planing up to the proper taper, make a tenon at each end to fit the mortises already made in the base and top bar. Before putting these three pieces together, provision should be made for the wires. The simplest way is to pass the cord from each light directly through the end of the top bar and connect them together so as to form a Y with a single cord running to the source of supply. The better way is, of course, to entirely conceal the wires and have the cord leave the lamp from underneath the base. This method necessitates the boring of rather long

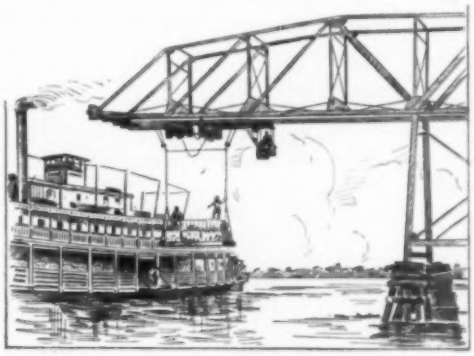


Method of attaching Shade to Socket.

holes, a matter which, in the absence of the necessary tools, can be readily disposed of at the nearest electrical shop.

BOAT AND RAIL CONNECTION ON THE MISSISSIPPI

A steel construction work, known as a "telpher" has been erected on the bank of the Mississippi, about three miles downstream from Memphis, Tenn., by a railroad company, to facilitate the transfer of freight between boats and cars. Planters, remote from railroad facilities and convenient to the river, ship their products by boat to the telpher, where it is transferred to cars. This is one of the many plans to solve the problem of landings and freight transfer on the river.



Telpher Transfer System on the Mississippi

The connection consists of a loading-platform on shore with the telpher system, ending in a cantilever truss over the river. A 30-ft. barge is used at present as a loading platform under the truss, but the telpher will probably be used before long to unload direct from the river boats.

INSTRUMENT FOR RAPID LARDING OF MEATS

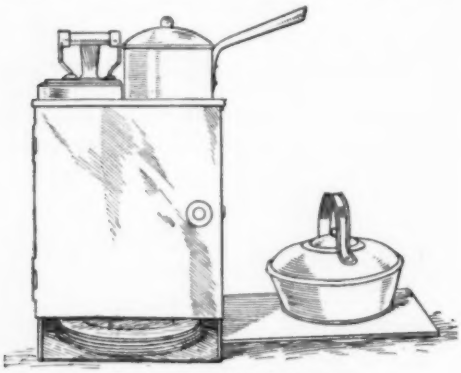
This illustration shows a butcher's tool for the rapid larding of meats. It consists of two parallel sections, one of which carries the piercing point, while the other carries the handle. The lardons, which are strips cut from flank-fats, brisket-fats, fat ends of bacon, etc., are placed in the hollow formed between the two sections. If they are long pieces, one end hangs down just forward of the handle. The tool, with the lardon in place, is forced through the meat until the point pro-

The Rapid Larder

trudes. The user pulls one section out by the handle, and the other out the other way by taking hold of the point-head, which is provided with corrugations enabling the user to get a firm grip upon it to pull it out.

INEXPENSIVE ELECTRIC COOKER

This electric cooker consists of an oven, 12 by 12 by 14 in. inside, with

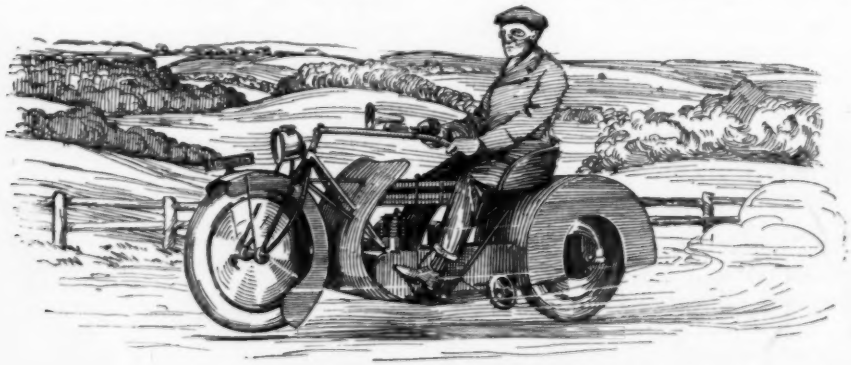


Economical Electric Cooker

the heating apparatus mounted on one side. This is carried on hinges so that it can be lowered, as shown in the illustration, for boiling, frying, etc., while in its ordinary position it heats the oven. Thus one heater can be made to do the work of two, although, of course, not at the same time.

THE MOTORCYCLE OF 1912

The change in motorcycle construction in Europe this year points to more radical changes in the coming years, and the final discarding of all types of machines with pedals and saddle seats. This illustration is a forecast of the machine of 1912, with duplex frame and mud-shield to protect the rider from mud and wind, roller wheels to prevent side-slipping, a bucket seat in place of the customary saddle, and an engine started by a crank mechanism instead of by pedals. The feet of the rider find a rest on the lower part of the mud-shield which extends down from in front of the rider and meets the shield that covers the rear wheel.



A Conception of the Coming Motorcycle

THE CHILLING OF BEEF FOR LONG SHIPMENTS

It is expected that the steadily increasing meat exportation from Australia to England will be even more rapidly increased through a process of chilling the beef. The initial shipment was 62 days in transit, but was received in excellent condition and brought prices equal to the best Argentine beef, though the time in transit was twice as long.

The process for chilling, as distinguished from freezing, beef, is the invention of a packer who has had a long experience in the trade both in Australia and the Argentine. After killing, the carcass is prepared and cleaned with all possible haste, and the sides and quarters are hung up in an insulated chamber, with plenty of air space between them, the chamber having been perfectly sterilized by both chemical and mechanical means. When the chamber has been filled, the contents are subjected to sterilization by a powerful germicide. The temperature in the chamber is then gradually lowered

to 32 deg. F., where it is maintained until the beef is placed on board ship.

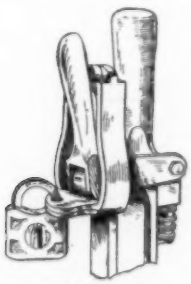
The beef, in cooling, gives off a certain amount of moisture. This is extracted, and the air is kept in a relatively dry state. The ship's hold must be similarly sterilized and prepared for the reception of the beef, and on arrival in London the beef is placed in chambers subjected to the same process. All the beef must be carried suspended to hanging rails, and in the ship's hold there must be apparatus for sterilizing the air and extracting the moisture.

In the first shipment from Australia to London the hold of the ship was prepared for the beef by reducing its temperature within 48 hours to 30.5 deg. F., which temperature was maintained throughout the voyage, except twice, when the hold was opened for examination.

An advantage the chilled beef has over frozen beef is that it "ripens" during its ocean voyage, and arrives ready for the table, while the frozen beef arrives in practically the same state as when it was killed, too fresh to be eaten.

LOCK PREVENTS TAMPERING WITH AUTOS

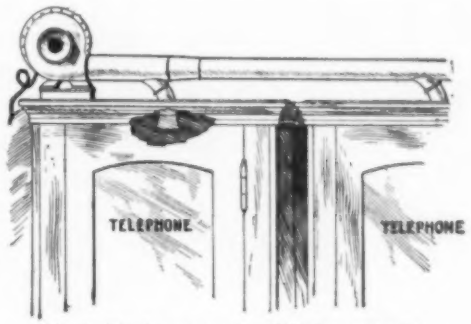
Many automobile accidents occur because someone, in a spirit of mischief or otherwise inclined, changes the positions of the operating levers when the car is standing still, thus bringing into action when the machine is started a gear which the driver thinks is thrown off.



Such accidents are made impossible by this new auto lock, which consists of a metal loop placed over the operating handle in such a way as to prevent the working of the latch. The metal loop is locked in place with a padlock.

VENTILATING APPARATUS FOR TELEPHONE BOOTHS

Fresh air at the rate of 50 cu. ft. per minute is blown into one or more telephone booths by this ventilating apparatus. It consists of a small inclosed fan, driven by an electric motor, and mounted on the top of one of the booths. The fresh air drawn into the fan is driven into the booths through tubes and diffused in a manner which makes the flow of air positive but gentle.



Fresh Air Apparatus for Telephone Booths

A feature of the installation is a device through which the air forced into the booths escapes. This device breaks up the sound waves, so that no sounds pass from the booths, thus insuring privacy.

STRENGTH OF NEW ALLOYS

Recent experiments with new alloys of copper, aluminum, and manganese show remarkable peculiarities. An alloy of 88 per cent copper, 9.99 per cent aluminum and 1.01 per cent manganese showed an enormous tensile strength, a cold-drawn bar having a yielding point of 40.88 tons per square inch and an ultimate stress of 52.08 tons per square inch. Another alloy proved to be so hard that it could take a cutting edge sharp enough to sharpen a lead pencil.

The British Admiralty has been experimenting with these alloys to determine their resistance to corrosion in salt water.

A GRAVEYARD SENTRY BOX

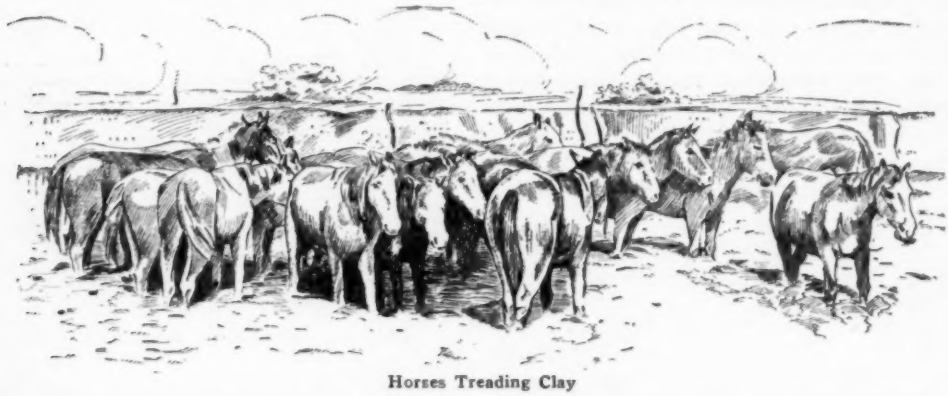
During the time, some hundred years ago, when body snatching was very common in the English cemeteries it became necessary to keep a sentry on duty at night. Some kind of shelter was required to protect the sentry from the weather, and, as ordinary wooden sentry boxes would look out of place among the tombs, the shelters were often constructed of stone, or of wood painted to represent stone.

Shelter for Graveyard Guard

The central piece in this illustration, which looks like the entrance to a vault, is a fine example. It still stands in St. Mary's churchyard at Wanstead, Essex.

HORSES MIX CLAY FOR BRICK

Horses play an important part in the mixing of clay for brick in the Argentine Republic, their feet doing the work that is done by machinery in the brick-making plants of the United States. The Argentine Republic is a country in which large quantities of brick are used, but nearly all of it is the "dobe" or sun-dried kind, and these find their way into building operations of all kinds. Such bricks usually receive an outer coat of plaster after being put in place.



Horses Treading Clay

The illustration shows horses at work in one of the brickyards just outside Buenos Aires. After a quantity of clay is placed in the inclosure, the water is turned on and the horses turned in. A boy with a long whip keeps the animals moving until the clay is mixed to the proper consistency.

ELECTRICAL FERTILIZATION OF SOIL

The average person probably believes that the impulse given to the growth of plants by a thunder storm is due altogether to the water the clouds discharge. Yet, according to Lionel Lodge, brother of the great English scientist, it is the electricity rather than the water that provides the remarkable impulse, and it is just such an effect that is now being artificially produced in the electrifying of crops.

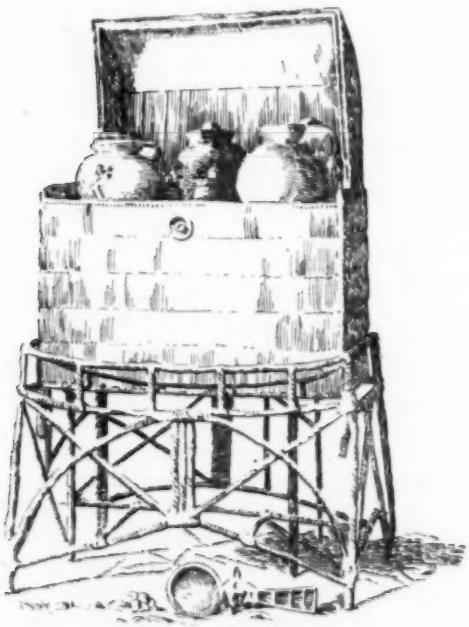
A year or so ago Sir Oliver Lodge advocated the use of electricity for reinforcing the fertility of soils, and since then the work has been carried on until now it has been taken up as a practical auxiliary of farming, both in England and on the continent.

The electric current required can be generated with dynamo or procured from the nearest supply company's circuit, and by means of a converter raised to about 100,000 volts. The field network consists of fine iron wire, the wires being spread about 30 ft. apart and about 18 ft. above the ground. The wires used are so fine as to be almost invisible, even when standing immediately below them.

With average soil the electrified area may be expected to yield 30 per cent more than a non-electrified area.

ANCIENT MEDICINE CHESTS

Both the medicine chests shown in these illustrations are designated as ancient, but one of them is more than 3,500 years older than the other. The very ancient one, which belonged to Queen Mentu-Hotep, was used about 2,200 B.C., and is therefore 4,110 years old. It was discovered at Thebes. The material of the chest is plaited papyrus reeds, and it is divided into six compartments, each containing a beautifully shaped medicine jar of Oriental alabaster. Various medicinal roots, and a wooden spoon were also discovered in it. The chest seen in the illustration was transported from place to place in a massive outer case made of wood, and decorated with hieroglyphics.



Medicine Chest of Ancient Egypt

Army Medicine Chest of 1588

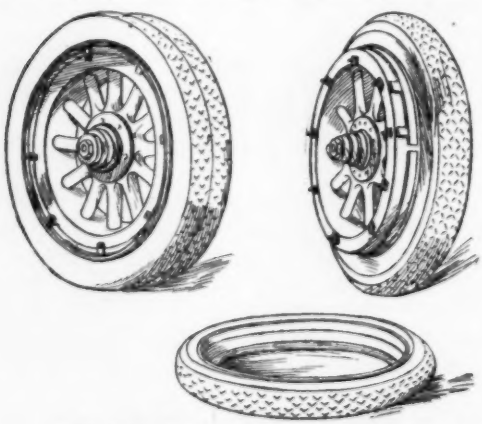
The other chest shown was probably used by William Clowes, a famous army surgeon of the sixteenth century. It is an enormous affair, provided with more than 300 varieties of medicines, some of which contained as many as 64 ingredients.

¶Sir William White, the eminent naval constructor, who designed the big Cunarder, "Mauretania," declared recently that the only limit to the size and speed of steamships is the item of cost.

DUAL PNEUMATIC TIRES FOR AUTO FIRE APPARATUS

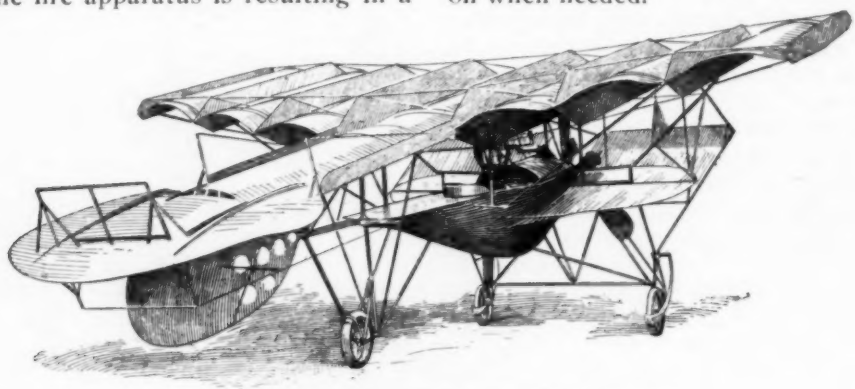
The steadily increasing use of automobile fire apparatus is resulting in a search for a tire that will be reliable and yet at the same time provide a fair amount of resilience. The ever present possibility of puncture or blowout makes the ordinary pneumatic tire somewhat dangerous, but a dual tire with demountable rims has now been designed and is said to do away with most objections.

The dual feature consists of two pneumatic tires mounted side by side. An injury to one tire is unlikely to affect the other, it is claimed, as the load can be carried on the good tire until an opportunity for substituting a new tire for the injured one occurs.



Both Tires in Place—One Tire Removed

To remove one of the tires it is necessary to loosen eight nuts and slip the demountable rim off. Substitute tires may be already blown up, ready to slip on when needed.



No Wood or Canvas Used in This Flying-Machine

STEEL-ALUMINUM AEROPLANE

An aeroplane made entirely of steel and aluminum, and provided with a surface under the driver's seat which is expected to cause the machine to float if it falls into the water, has been built and successfully tested out by an American living in Paris. The builder is a Mr. Moisant, who has made a number of short flights in it.

The wings are made of thin aluminum, and the lower parts are of steel. The driver's seat and the motor are placed on a surface or car built to float on the water and provided with two flat stabilizers, one on each side.

THE FRENCH RAILROAD INTO CHINA

The completion of the French railroad from Tonkin, French Indo-China, to the ancient Chinese city of Yunnanfu, over 500 miles beyond the mountain ranges, makes an artery of steel from the coast to the dark interior. In some districts the road has cost over $30,000 a mile to build, while an average of $25,000 a mile is a conservative estimate of the amount expended.

The railroad, according to the Pall

Mall Gazette, is a magnificent tribute to the French engineers who have battled with all known difficulties and a few more added. It pushes out through the paddy fields near Hanoi, demanding the building of no less than 175 bridges, one for almost every mile, through the broken land of Laokai, then shoots northward, now following the river's course, now across unhealthy marsh, dodging a 6,000-ft. mountain, and losing itself in the deep gorge beyond. So it continues, over dozens more bridges, around more mountains, down into more gorges, to Yunnan-fu.

PEDAL STARTER FOR AUTO ENGINES

An interesting device for starting the engine of an automobile without leaving the seat, and without requiring the use of the hands, is shown in this illustration. It is known as the pedal starter, and consists of ratchet-wheel fixed to the clutch shaft of the car and operated through a pawl by a pedal under the driver's foot. By pressing on this pedal the shaft is revolved and the engine set in motion.

ROCHESTER'S NEW POLICE TELEPHONE SYSTEM

Rochester, N. Y., has a new police telephone system which is to be supplementary to the ordinary patrol box system, and by which calls are handled through the switchboard of the regular telephone company. The telephones are ironclad and mounted on iron pedestals located on street corners. Each telephone set is equipped with loud-ringing gongs, rung by the "central" operator, so that the patrolmen may be called while traveling their beats, as well as being able to call up headquarters themselves.

Police Telephone Box in Rochester, N. Y.

"LITHOGRAPHIC" PLATES OF NICKEL

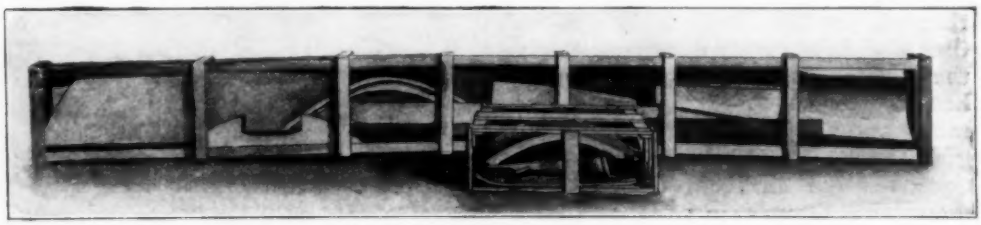
A new German process allows of the use of electro-deposited nickel plates in place of the very fine grain stone now imported from Germany for the printing method called lithography. A brass slate or one of some other metal, scoured so as to allow the ink to take to it readily, is coated with graphite or other material. A thin coating of nickel is then given this by electro-deposition, after which a heavy zinc deposit is put on and the two deposits stripped from the brass or other metal plate. The nickel is then left with a surface immediately available for lithographing, and is used in place of the lithographing stone.

This stone is now in almost universal use. It is a variety of limestone, and owing to its cost and weight in large sizes a substitute has been sought for a long time.

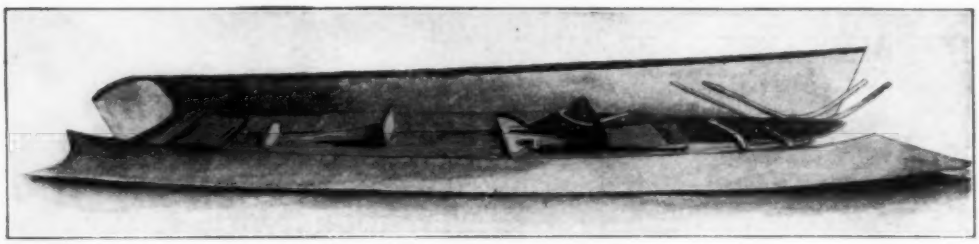
¶The total of building contracts recorded in San Francisco since the earthquake and fire amounts to $163,010,438.

KNOCKDOWN METAL MOTORBOATS

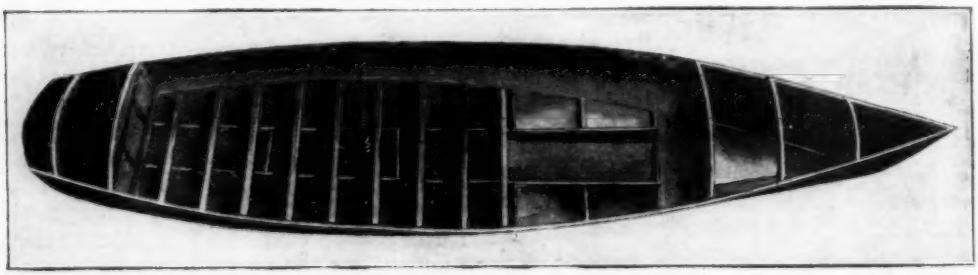
Knockdown motorboats of wood have been on the market several years, but these illustrations show the knockdown principle as adapted to steel



Crated for Shipment



Unpacked and Ready to Assemble



Interior View Without Decking

Side View Without Decking

motorboats. The first shows the complete hull crated for shipment; the second, the hull ready to assemble; the third, everything in position but the deck, flooring, and seats, which are of wood; and the fourth, a side view of the hull.

INGENIOUS SYSTEM OF APPOINTMENT BOXES

An automatic appointment box system which may be installed in various places, such as hotels and railroad stations, so that the public, by the expenditure of a small sum may leave and receive a message has been devised by some bright minds. The working of the box is best explained in the following manner:

Brown has an appointment to meet Green at the appointment box at the

railroad station at 6 o'clock. A half hour before comes a telephone message from a client of Brown's making an appointment at the city hall, also at 6 o'clock. The latter engagement is an important one from a business point of view, while that with Green is merely personal. Brown, therefore, on his way to the city hall stops at the railroad station and leaves a message in the appointment box, making a further appointment with Green for, say, 7 o'clock. Green arrives at 6 o'clock and, failing to see Brown, drops a coin into the box, after which he turns a handle and sees Brown's note.

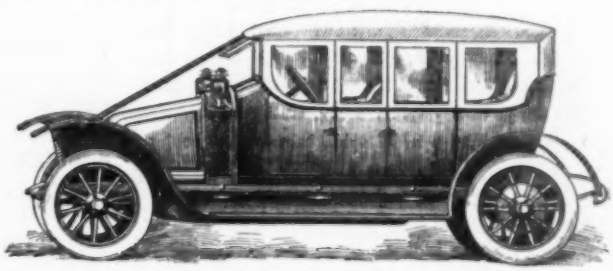
In the top of the box are two metal lids. In the first of these one inserts a coin, and, lifting the lid, finds a celluloid pad on which the message is written. The second lid, on the insertion of a coin by the person expecting to find a message, shows the message protected by a glass cover, and thus rendered immune from erasure or alteration. By means of a handle the roll of celluloid may be wound back, until any of a number of messages wound upon it can be seen, but in this unrolling it does not pass under the first lid, consequently cannot be touched. On releasing the handle, the roll is automatically rewound, until a blank space is available for the next person who wishes to leave a message.

The messages can, of course, be read by anyone placing a coin in the box, but with ordinary appointments this need not matter.

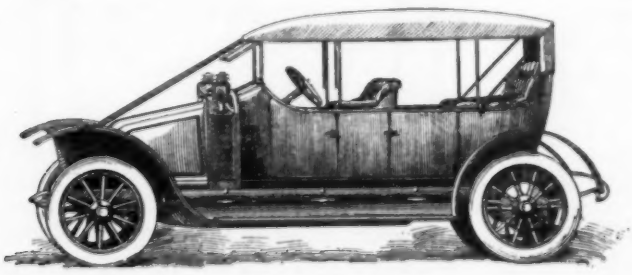
¶A solid train of 21 cars of cartridges and shells, approximating 750,000 lb. in weight, which was shipped recently from an Ohio ammunition factory, is said to be the largest single shipment of the kind ever made.

QUICKLY DETACHABLE LIMOUSINE

A French automobile manufacturer has brought out a new adaptation of the torpedo body, making the addition of a limousine a simple matter. The torpedo body is not radically different from the types seen in the United States. In nearly every instance the purchaser of the car finds it to his advantage to buy the detachable limousine also, because of the comparatively small additional cost. The upper part can be put on in a few minutes, and the fair weather car is made very comfortable for winter use.



Torpedo Body with Detachable Limousine



Limousine Detached

With the great majority of machines the substitution of a limousine for the regular open body entails much labor and expense.

¶A reinforced concrete building, 295 ft. high from street level to the top of its towers, has been built in Liverpool, England.

HOW TO MAKE A FOLDING CARD TABLE

The accompanying sketch shows the details of a card table that can be folded up and carried about or stored away when not in use. We would advise

Legs Extended and Folded

making two tables at the same time, as the material for both can be purchased nearly as cheaply as for one. The material necessary for making one table is given in the following list:

1 piece, ⅞ by 1⅜ by 27½ in., basswood or poplar.
2 pieces, ⅞ by 1⅜ by 29¼ in., basswood or poplar.
4 legs, 1 in. square, 24¾ in. long; oak.
4 pieces, 1 in. square, 5 in. long; oak.
4 side pieces, ⅜ by 1⅛ by 29⅝ in.; oak.
4 pieces, 27½ in. long, single groove electric wire moulding with batten.
1 piece cardboard, ⅛ in. thick, 29¼ in. square.
4 pieces brass rod, ⅛ in. diameter, 15 in. long.
30 small copper washers, ¾ or ⅞ in. outside diameter and drilled ⅛ in.
4 brass corners, 1⅜ in. deep.
2½ doz. No. 5 oval head brass screws, ¾ in. long.
4 No. 2, ⅞-in. rubber screw tips.
1 piece felt, 1 yd. square.
1 sheet wadding, 1 yard square (if pad is wanted under felt).
1 pt. wood stain.
3 doz. No. 14 wire beads, 2 in. long.
Some 2 oz., 4 oz., and 6 oz. flat-head tacks.

Begin by squaring up the four legs, making them all 24¾ in. long and 1 in. square. Also square up the crosspieces marked B in the detail drawing. These should be 5 in. long and should have ¼-in. holes about 1 in. deep drilled in both ends of each for the ¼-in. oak swivel pins. Measure back 1½ in. from one end of each and bore a $\frac{9}{16}$-in. hole, ⅞ in. deep as shown. Now cut a tenon, ¾ in. long, on one end of each leg to fit tightly in this $\frac{9}{16}$-in. hole. Round the corners of the piece B at the top as shown at C. Fasten the two pieces together with glue and brads, being careful to get them square with each other. After the glue is set bore a $\frac{3}{16}$-in. hole in the center of the leg, 7 in. from the edge of the crosspiece, for the brace rod. Bevel the corners as shown. Sandpaper them smooth, then stain and polish.

Lay the two pieces marked D and E in the sketch on a level surface with the ⅞-in. edge up, place the cardboard on top and tack it fast to the pieces, using 6-oz. tacks. Place the center piece in and tack it fast also. Fasten the ends to the other pieces with brads. The four pieces of electric wire moulding should each measure exactly 27½ in. long, or the same length as the center piece. Fit a piece of wood about 4 in. long in the groove at each end of the moulding, plane down and fasten with brads. Next take the thin batten or covering strip that comes with the moulding and bore a ½-in. hole in the center 6 in. from one end and a ¼-in. hole $8\frac{3}{16}$ in. from the other end. With a gouge cut a slot ¼ in. wide from one

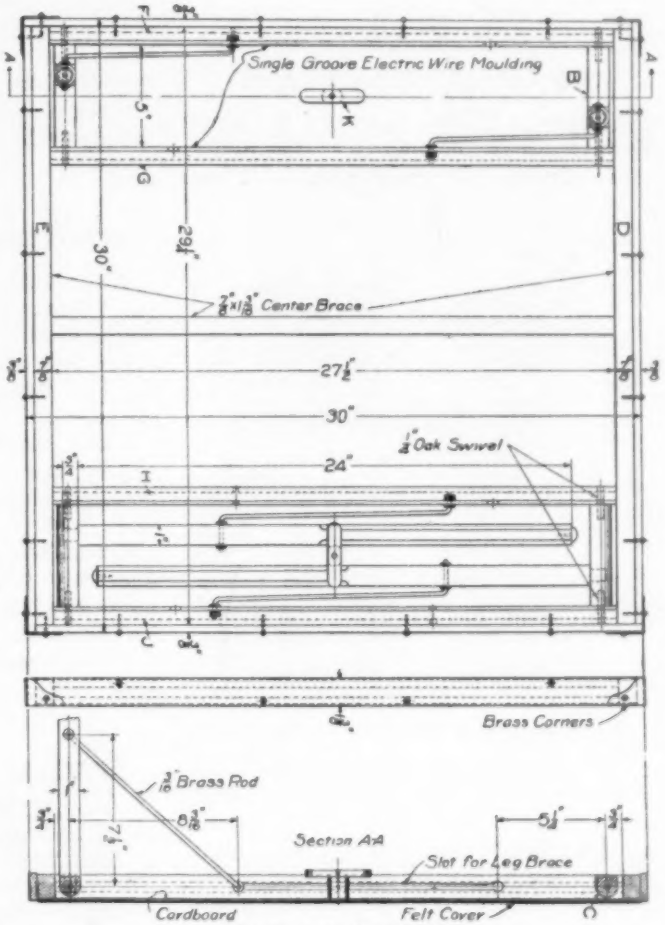
Card Table Complete

hole to the other in the center as shown in the section A-A. Sandpaper this slot smooth and then fasten the batten to

the moulding with small brads driven in about 2 in. apart. At a point ¾ in. from each end and in the center drill ¼-in. holes through the moulding at the small ends of the slots. These are for the ends of the brace rods to spring into, to lock the legs when they are open. Tack the two pieces of moulding marked F and J on the remaining edges of the cardboard with the slots facing in and the large holes of the slots at opposite sides, then place the other two pieces (G and H) 5 in. inside of these, or just the length of the cross ends of the legs, with the slots facing the first two placed (F and J) and tack fast with 4-oz. tacks. Use brads at the ends and be careful that they do not enter the ¼-in. holes. This part of the table can now be stained or painted the same as the legs. The ⅜-in. side pieces can also be stained.

The ends of the brass rods can be bent in a vise. One end should be 1 in. long and should be square with the stock. Measure 11¼ in. center to center and bend in opposite direction leaving this end at a slight angle out from square. Just at this bend raise a burr with a sharp chisel to keep the washer on. Now place five of the copper washers on the 1-in. end and batter the end of the rod so they will not slip off. They should be loose so that they will roll and slip on the brace. Slip a washer on the other end and put the end of the rod through the $\frac{3}{16}$-in. hole in the leg from the short end side, place another washer on the rod, saw off and rivet down the end.

To put the legs in the table, slip the end of one of the braces and the washers in the large hole in the slot, shove it up until the ¼-in. hole in the crosspiece and the one in the moulding meet,



Details of the Card Table

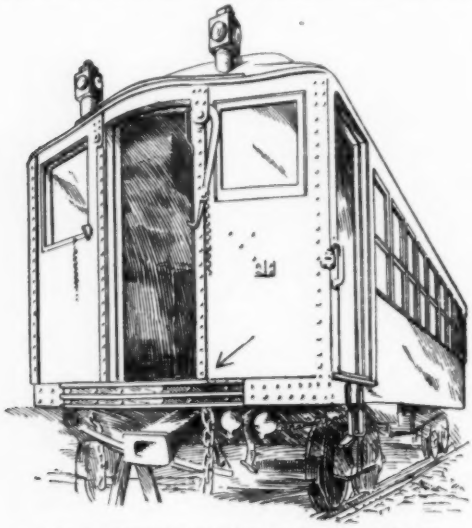
then drive an oak dowel or rod into each end. This is the hinge or pivot that the legs swing on. When the leg is extended the end of the brace rod should spring into the ¼-in. hole in the moulding and lock the leg in place. Rubber tips should be put on the bottom ends of the legs. Two wooden buttons should be made and fastened to the cardboard as shown at K for locking the legs when they are closed.

The felt can now be put on the top of the table. Stretch it tightly and then

tack the edges securely to the sides of the table. Now fasten on the ⅜-in. side pieces and the brass corners with the small brass screws as shown on the drawing, and the table is complete.

DEVICE PREVENTS TELESCOPING OF RAILROAD CARS

A recent collision in one of the New York tunnels, caused by the dense smoke from a fire, which made it impossible for the motorman of one train to see the other, afforded the first practical test of a new device for preventing the telescoping of cars.



Car Equipped with Non-Telescoping Device

This invention consists of two series of large teeth or cogs at the end platform of each car which interlock when the cars come together and prevent them from rising. When the collision occurred, the apparatus immediately and automatically interlocked, and the telescoping which might otherwise have occurred was prevented.

GERMAN SUBSTITUTES FOR TURPENTINE

German concerns are manufacturing substitutes for turpentine in rapidly increasing quantities. It is obtained by the distillation of heavy petroleum from Borneo and sells for nearly two-thirds less than American turpentine. Its greatest use is in the paint trade.

The ordinary light American petroleum is not available for the manufacture of the turpentine substitutes, according to the German manufacturers, but it is believed that some of the grades obtained in Texas and California might yield results comparing favorably with those obtained from Borneo oil.

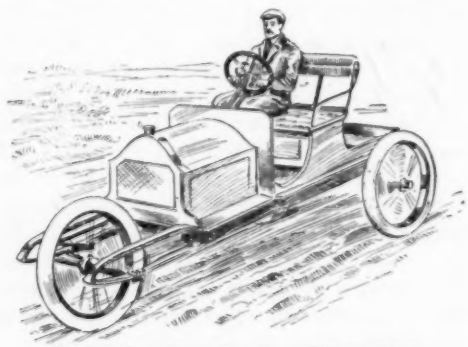
IRRIGATION IN AUSTRALIA

About 2,200,000 acres of grazing land in Australia is watered by artesian wells, and a further area of 380,960 acres will soon be added to the grand total by artesian bores now being undertaken.

Many of the rivers of New South Wales are simply drainage channels running through flat country, flowing after heavy rains and dwindling to a chain of water holes during periods of drought. Ranchers, in some instances, have excavated tanks to catch water for their stock when the rivers were flowing, but this has not always proved successful.

SPECIAL THREE-WHEELED AUTO FOR COSTA RICAN ROADS

The roads of Costa Rica, notorious for deep ruts which make touring with the usual type of automobile almost

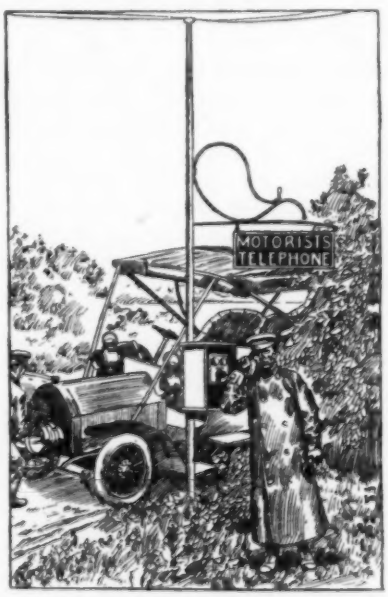


Designed to Steer Car Out of Deep Ruts

impossible, are responsible for the peculiar type of auto shown in the illustration. The car might prove just as useful, however, in other countries afflicted with deeply rutted roads. It is well nigh a mechanical impossibility to get out of many of these ruts with the four-wheeled auto without assistance. With the newly designed car, however, the front wheel runs between the ruts, and makes it possible to steer out of the track. With the exception of the single wheel in front, and the slight alterations of the frame to suit it, the chassis follows the usual design.

AN AUTOISTS' TELEPHONE

In the section about Bournemouth and Christchurch, England, are a number of telephones erected for the express use of autoists. When a machine breaks down, or the gasoline runs short, the driver telephones to the



The Autoist's Telephone

garage that forms the center of the telephone system.

The same plan is being tried by several auto-repair concerns in this country, also.

A TYPEWRITER CARRIED IN THE VEST POCKET

This typewriter, shaped like a watch and carried in the vest pocket, can ac-

Watch-Sized Typewriting Device

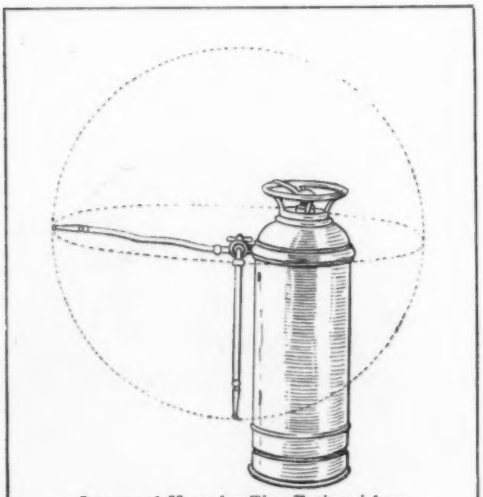
tually be used to make impressions on a narrow strip of paper. The letters, figures, and punctuation marks can be seen on its back. The disk holding them turns, and the typewriter is operated by means of a knob in the ring, to which a chain may be attached as with an ordinary watch.

AIR PRESSURE IN AUTO TIRE KILLS MAN

One of the most curious causes of death in which an automobile has ever played a part occurred at Marcus Hook, near Chester, Pa., when air pressure in a detachable rim tire blew off the bead ring. The automobile was owned by Charles G. Guyer, of Wilmington, Del., and the man killed was Frank D. Marshall, his brother-in-law. The former was pumping air into the tire, and the latter was seated on an enbankment watching. The flying bead ring struck Marshall in the face, cutting his head almost in two, and causing his death ten minutes later.

FLEXIBLE HOSE FOR FIRE EXTINGUISHERS

A flexible metal hose attachment for fire extinguishers that may be swung



Improved Hose for Fire Extinguishers

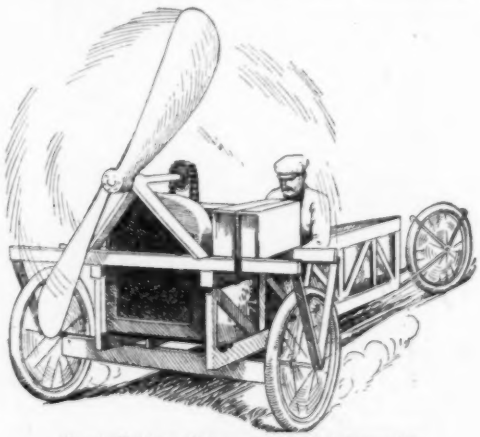
in any direction is shown in this illustration. Vertically it covers 360 deg., and laterally more than 180 deg. The hose is lined with a rubber tubing, and hangs vertically on the extinguisher, a universal joint giving it the wide range of action.

PAY-AS-YOU-ENTER CARS NOT A NEW IDEA IN STREET RAILWAYS

According to the Brooklyn (N. Y.) Rapid Transit Company there were about 50 pay-as-you-enter cars in operation in Brooklyn during the Civil War times. The driver's platform on these cars was entirely enclosed by a metal dashboard, but the conductor was stationed on a narrow seat at the end of the rear platform, the entrance to which was guarded by sliding doors under the control of the conductor. These cars were relegated to the scrap heap, a variety of bob-tail cars being substituted for them. The pay-as-you-enter car bobbed up again, however, in the 90's. Despite the fact that the surface lines of Brooklyn had been electrified previous to 1895, some six or seven short-body horse-cars still performed a shuttle service from Brooklyn, across the Vernon avenue bridge through Long Island City. After 1895 the shuttle service was reduced to one car, a sign along the top of which announced "Pay as You Enter, No Transfers." In the interest of public safety the horse-car tracks upon the bridge were torn up in 1900 and the horse-car was sent to the basement of the barn of the railroad at Third avenue and Fifty-Eighth street to be preserved as a relic. Two years ago, however, it was mounted upon a truck and accorded a place of honor in the parade celebrating the completion of the subway under the East river.—Contributed by G. J. MacMurray, Brooklyn, N. Y.

WIND WAGON MAKES 25 MILES AN HOUR

A wind wagon, the name given a vehicle pulled or driven by an aerial propeller, has been creating considerable interest lately on the streets of Louisville, Ky. It consists of a wooden frame, supported by bicycle tubing and was designed for testing and perfecting



Road Vehicle Driven by Aerial Propeller

a propeller to be used on aeroplanes. The curious vehicle can make a speed of 25 miles an hour on a good road.

SOILED BILLS MAY NOW BE SENT TO THE MONEY LAUNDRY

After a journey through many hands, now passing quickly from one owner to another, now stored away in some old and worn leather wallet, the soiled and weary dollar bill may take a trip to Washington, the place of its nativity, there to bathe in the refreshing soap-suds of the new washing machines, and emerge, clean and crisp, ready to go forth again on its travels.

The Treasury Department at Washington has just installed a number of machine to wash, disinfect, and iron soiled paper currency, giving to the old and begrimed bill its pristine crispness. A large percentage of the bills now returned to the department for redemption will be put through this laundering process, and returned to the banks sending them in. It is estimated that a billion dollars a year will be subjected to this treatment. Hundreds of thousands of dollars will be saved by the government, for it will reduce the number of bills made every year by the Bureau of Printing and Engraving, that branch of the Treasury Department devoted to the manufacture of currency.

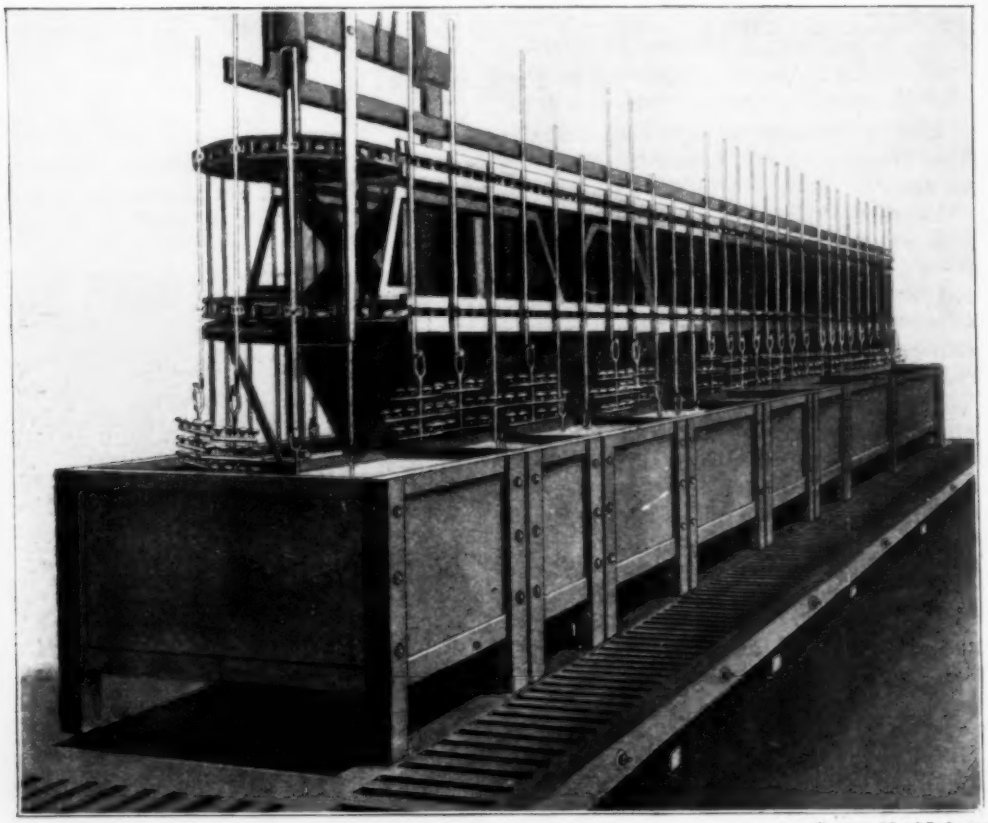
The machines used for the purpose are simple. There is no secret to the laundering operation, for the soiled bill is subjected to about the same treatment that a soiled linen collar would receive. The illustration shows the motor-driven washing machine. "Starching" is the next step, the clean but limp bill being run through a "sizing" machine which restores its surface. It is then placed in a powerful press from which it emerges as crisp and fresh as newly made money.

New Washing Machine for Cleaning Soiled Bills

AUTOMATIC ELECTROPLATING MACHINE

An automatic electroplating machine which will accomplish as much work in an hour as the ordinary force of men can handle in a day is shown in the illustration. It was invented by the director and manager of a Canadian manufacturing company, who clung to his idea until he had perfected it, although at the start he was more or less criticised and ridiculed.

The output of the machine is remarkable when viewed from the standpoint of general practice. Steel door knobs, plated with copper, brass, or bronze,



Courtesy Metal Industry

Automatic Plating Machine Which Turns Out 2000 Articles an Hour

are turned out at the rate of 2,450 per hour, while a day's work on these articles as ordinarily done by hand is only 2,000. Door locks, which are plated in the same way, are plated at the rate of 1,800 per hour, while 1,500 has been considered a day's work. Other articles are plated at the same speed. Boys serve as operators.

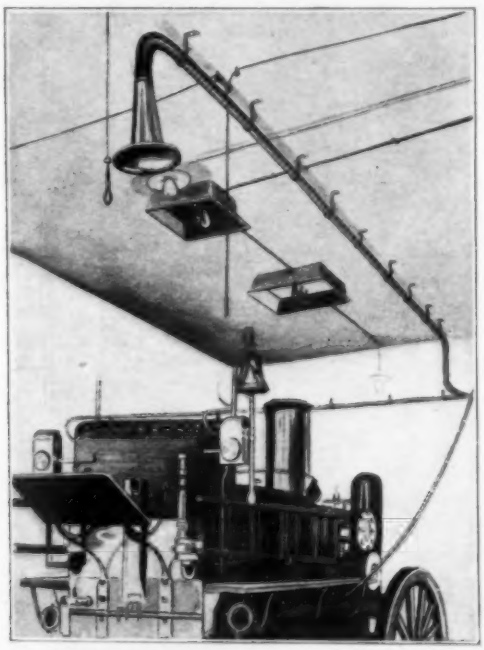
The machine consists of a framework built in the form of an oval. Grouped about this frame are the tanks containing the solutions used in the process. On the framework and close to the top of the tanks runs a metal track in the form of a flat narrow strip. This strip rises sharply to the top of the frame when it comes to the end of a tank and dips again when over the next tank. At regular intervals are placed flat pieces of metal, terminating in hooks on which are hung racks to hold the articles being plated. These pieces are provided with rollers which allow them to be drawn along the track by power.

In operation, the boys place the articles to be plated on the racks and hang them on the hooks. The strip carries the racks over the edge of the first tank, and immerses the articles in a cleaning solution. Then the strip rises, lifting the racks out of the tank, and dips again while over the next tank. This process is carried on until the tank containing the plating solution is reached, the racks being moved steadily along the strip through the entire process. By this time the articles are in condition for plating, and the length of the plating tank is so arranged with relation to the speed of the rack that the articles are completely plated by the time they reach its end. No further operation is needed but to dry in sawdust and finish in whatever manner required.

The electrical contact is made as soon as the racks touch the plating solution, by reason of the track upon which they run being charged by the negative pole of a circuit. There is absolutely no touching of the racks by hands from the time they start from one end of the frame until they reach the other with their loads of plated articles. The power required to operate the machine is only part of a horsepower.

SIGNALING DEVICES IN LONDON FIRE STATIONS

Two new signaling devices have been installed in the fire stations in London to expedite the giving of orders. One of them is a trumpet, hung along the wall in such position that the operator in the watch-room may talk to the drivers on the seats of the apparatus, thus making the shouting of orders unnecessary. The other is a set of colored electric lamps, a different color for each vehicle. The illumination of these shows just what vehicles are to answer the alarm.



Trumpet and Signal Light Arrangement in Fire House

BUYING TICKETS FOR AERIAL FLIGHTS

An extraordinary scene, which before long will seem very ordinary and commonplace, is depicted in this illustration. Early in June a booking office was opened at Ranelagh, one of England's aviation fields, for the selling of tickets for aeroplane flights. The price charged for each flight with a skilled pilot was $50, and the majority of buyers were women. The first ticket was sold to a woman of title who desired to experience the sensation of flight. Many other women followed her example.

Courtesy Illustrated London News
A Ticket Office for Aeroplane Flights

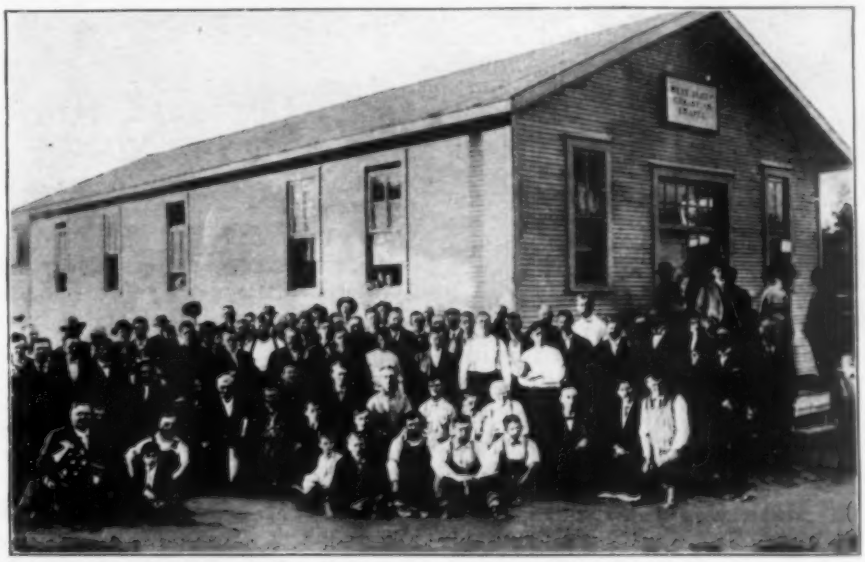
SECOND-CLASS SLEEPING CARS IN JAPAN

The Takaido line of the Japanese railways has inaugurated a system of second-class sleeping cars said to provide excellent accommodations, as the beds are 5 ft. 9 in. long, an unusual length in that country. A berth only 5 ft. 9 in. in America would be considered too short to be slept in by an ordinary-sized man, but the Japanese are so much shorter that the less than 6-ft. berth is thought very commodious.

Progressive Stages in the Construction of Church Built in a Day

Church Built in One Day

When a wooden building is to be erected in a newly settled country a building bee is arranged, the neighbors for miles around gather on a certain day, and before evening the framing, walls, and roof are up. That such an event, however, need not necessarily have a new part of the country as a setting was demonstrated when a church, 60 ft. long by 24 ft. wide, was built in 10 hours by 200 men of Peoria, Illinois.



Church at Peoria, Ill., That Was Built in a Day and the Workmen Who Accomplished the Feat

The foundation of the chapel, which is known as the West Bluff Christian Church, was laid by its pastor, the Rev. W. F. Turner. At 7 o'clock sharp the men of the Christian Church Brotherhood arrived on the ground and piled the lumber for 65 carpenters, who arrived at 8 o'clock. The work commenced at that minute. The side and end walls were up at 8:45, and the siding was put on rapidly. The rafters were next completed, the roof framework erected, and the strips of prepared roofing put in place. No sooner was the siding on than men with buckets of paint appeared and began to give the building its first coat of white paint. As soon as the painting gang commenced work, another gang started the work of ceiling the interior. At 6 o'clock the church was completed, including much extra work, such as the building of a coal house, grading the church yard, and installing an organ. At 6:30 o'clock the first service was held.

ILLUMINATED BALLOONS TO LIGHT AIRSHIP ROUTES

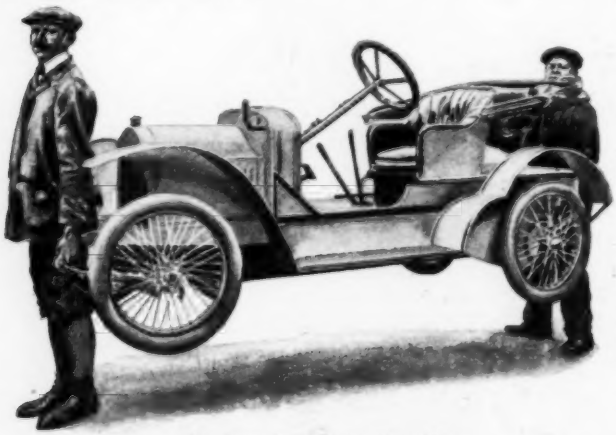
Towers equipped with searchlight projectors are suitable for the lighting of airship routes and stations under ordinary conditions, but fail when the airship is over the clouds or in a bank of fog. In attempting to solve the problem a German inventor has devised a system which consists principally of illuminated balloons made of rubber and containing electric light bulbs. These balloons are carried above the fog or clouds by captive balloons or kites provided with conductors.

ELECTRICALLY LIGHTED CAP WITH LIFE-SAVING APPARATUS

A Belgian inventor has devised a life-saving apparatus that, in addition to keeping a person afloat, protects the neck from the force of the waves and is provided with a cap attachment holding a small electric light. The light greatly enhances the chances of rescue at night, as it can be seen for a distance of a quarter of a mile.

On account of the position of the cushions of this life-saving belt, the neck is protected against the stroke of the waves, preventing the head from tossing about in case of syncope.

It is claimed that in case of an explosion caused by a torpedo, a submarine mine or the wrecking of a ship by other means, all the sailors and passengers can remain afloat and be saved as, owing to the shape and softness of the cushions, the apparatus serves as a pillow, holding the head above the surface of the water.



An Auto Carried by Two Men

The accompanying illustration shows the method of using this "insubmersible" life belt. The apparatus prevents death by immersion as the wind or waves cannot make the body capsize in the water. It is of scapular shape, composed of a breast cushion and a dorsal cushion. The shape of the apparatus and its lightness allow entire freedom to the limbs, so that the person wearing it can execute all the movements of swimming with no inconvenience whatever.

MEN'S COLLARS MADE OF GOAT'S MILK

Imitation celluloid collars made of goat's milk are the latest fad in Paris, as well as being generally adopted by artisans, tradesmen, waiters and coachmen. The milk collars are said to be as serviceable as the celluloid, and to have less of a polish, which makes them a great improvement. In preparing the milk for collars the curds are drained off the whey and subjected to a terrific pressure, resulting in a substance that looks very much like celluloid.

Milk curds have been used in Europe for some years for the making of billiard balls, combs, imitation-bone knife handles, and collar buttons.

EXCEPTIONALLY LIGHT-WEIGHT AUTO

This illustration shows two men lifting an automobile that is making a favorable place for itself on the European market. It is of the small, comparatively inexpensive type of which there are several examples in this country. That it is exceptionally light, even for a small car, is apparent. The motor is a 2-cylinder V-shaped Anzani. The tiny car is very speedy, and is said to be an excellent long-distance machine on good roads. When hood is not used, rumble seat may be fitted at back.

Receiving Messages Through Umbrella Frame

Listening to Wireless Caught by Up-ended Wire Cot

ODD AIDS Or "WIRELESS" AMATEURS

By P. J. BURROWS

IN a little Philadelphia home, F. B. Chambers, a wireless enthusiast has been demonstrating the wonderful possibilities of aerial communication. The popular idea that to converse by wireless entails a large preliminary expenditure for an outfit is quite a mistaken one. This man talks to his wife through the ribs of an umbrella, through a common dishpan, and by means of such ordinary material as a wire clothesline.

The possibilities of using this form of wireless communication that suggest themselves are unlimited. For instance, it will be easy for boys who are camping to be in touch with their homes by merely stretching wires between two trees, the wires being a few yards of clothesline which can be purchased by the reel for 35 cents at any hardware store.

A tin washbowl can be found at any camp or summer cottage and this provides a perfectly satisfactory means of catching the wireless words that cavort around the atmosphere.

But if the campers have been so forgetful as to omit a tin washbowl from their equipment, then there are several substitutes within easy reach. Chambers proved this by up-ending a cot that had a wire support for the mattress and, with this as a receiving implement, the ticking started at once, messages that were being sent to the Philadelphia Navy Yard being plainly heard through the receivers clamped to the ears. There will probably be a

Dishpan Serving as a Receiver

The Chambers' Aerial, Rising Above Roofs on Ninth Street, Philadelphia

dozen other articles lying around a camp or summer home within easy reach that can be adapted to receiving wireless messages in the way explained.

It is not possible, of course, to send messages by the simple devices used in receiving. The conversation carried on through the washbowl, the up-ended cot, or the umbrella frame, is a one-sided conversation. The person holding the umbrella or listening through the washbowl or the wires of the cot can hear what is said from the wireless station at the other end, but he cannot

Catching Wireless with Wire Clothesline

Mrs. Chambers at Wireless Instrument in Her Home

talk back. To do that he must have a wireless station at his end, which of course is only practicable at a permanent home or stopping place, as the installation in a camp or temporary abode in the woods would entail considerable labor and expense.

"I have great fun calling my husband at night," says Mrs. Chambers, who has learned to operate the wireless apparatus at her home. "I agree with him, when he is away from home, to call him at a certain hour and then he can hear all the news by way of the umbrella aerial or by hitching his receiver to an improvised aerial in the vicinity. He also finds it entertaining, he being a wireless enthusiast of the most intense kind, to listen to the messages flying around at night. The appliance which makes it possible for him to receive wireless messages, but not to send any, can be carried in a suit case. It cost him about fifteen dollars to make it and he and I have had many times that amount of fun out of it.

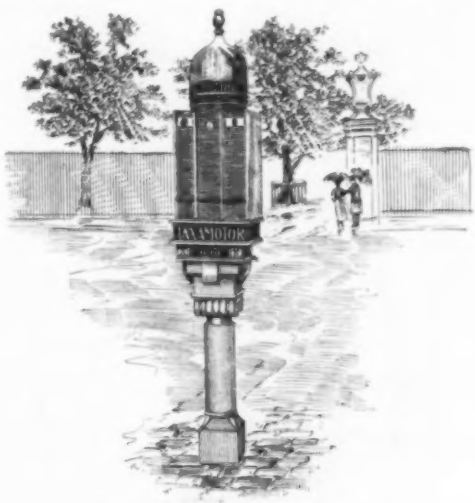
"Sometimes, when he is in the neighborhood of a wireless station, he will fraternize with the operator and then if the station is not busy we talk to each other in the regular way, the aerial we have on the house being as strong as any at the regular wireless stations.

"These mutual talks are interesting, but I have the greatest fun when I get him with his portable receiver and can do the talking myself without his being able to reply. The fun is not lessened by my knowledge of the fact that every wireless operator in the radius is in on the conversation and hears just what I am saying to my husband. The other night he was in the suburbs on business and I tried for a long time to pick him up. All the wireless operators around who happened to be at leisure joined me in the hunt and the air was warm with such messages as: 'Chambers, your wife wants you;' 'Chambers, you're going to get it when you get home;' 'Hello, Chambers, hot-foot it to Ninth Street,' and so on. I learned when he came home that he had caught most of the messages and the following night he amused himself calling up the wireless stations and jollying the operators who had been kind enough to join in the wireless hunt for him.

"It is this novel feature of the wireless operating that makes it so charming. All unknown to the citizens, there is going on in the air above them a constant exchange of ideas by wireless operators who have never seen each other. My husband and I sit in our wireless room in the evening and talk by the hour to the boys who have rigged up stations. It is surprising how many there are who are striving to become proficient in the Morse code."

TELEPHONE CALL-BOX FOR TAXICABS

Telephone boxes like the one shown in this illustration have been placed at many conspicuous places in Copenhagen for the express purpose of calling taxicabs. When the taxicab reaches the box the driver has to report to headquarters, so that the book-clerk can tell just where the cabs are.



Taxicab Call-Box in Danish City

¶The total amount of the cash prizes for aerial flights already won or to be competed for during the year 1910 is nearly a million dollars.

The Coming of a Sandstorm

WOOD-SCREWS WITH SOCKET HEADS

Instead of the commonly used slot across the head of the ordinary wood-screw, this screw is provided with a square socket, which is a radical innovation. A driving point, formed to set in the socket, takes the place of the usual type of screw-driver. The advantages claimed in driving this screw are: No wobbling or slipping of the tools, absolute control in difficult work and no marring of the screw or of the work being done.

¶A man-eating shark, in which undigested human bones and a camera plate were found, was captured recently by the crews of two fishing boats in the Strait of Juan de Fuca, British Columbia. The shark was 36 ft. long and weighed 15 tons.

A SANDSTORM IN EGYPT

During the rainy season in Khartoum, Egypt, sandstorms (haboobs) are of very frequent occurrence. The heavy, sun-obscuring volume shown in this illustration might be taken for the smoke arising from a dozen burning oil tanks, but it is composed of veritable cliffs of sand, swooping along with great rapidity.

When such a storm is seen approaching a community, alarm gongs are sounded and the inhabitants rush to a place of safety.

VIENNA'S NEW WATER SUPPLY

Vienna's new water system will be formally opened on Dec. 2, the eightieth birthday of Emperor Francis Joseph. The water is carried from springs in the Alps by an aqueduct about 113 miles long which has 6¼ miles of branches extending to a number of springs not on the main line. Along the greater part of its length the aqueduct, which is about 7 ft. high and

6 ft. wide, is constructed of concrete. Some 45 miles of the length of the aqueduct is in the form of tunneling. The work of construction has been in progress about 10 years and the system will supply 51,300,000 gal. daily, which will relieve the present serious scarcity of water. With the old system only 35,000,000 gal. could be obtained under the most favorable conditions and this has often sunk to only 26,000,000 gal. per day. The water from the aqueduct will arrive in Vienna under sufficient pressure to supply most sections, but there are six small high-service districts to which water must be pumped.

A HANDY AUTOMOBILE SEAT

The problem of carrying an extra passenger on an automobile has been very ingeniously solved by a recent invention, a removable seat which is placed over the running board of the car. It is very small and takes up little room and in some respects is more comfortable than an extra seat crowded into the tonneau. The main disadvantage is that it requires a good strong grip to keep the passenger from being

Removable Seat for Extra Passenger

jolted out when passing over the rough places. Also, it is not designed for persons of the build and weight of our chief executive.

OILING THE BATTLESHIP "DELAWARE"

The U. S. S. "Delaware," the first battleship in our navy to burn oil fuel

Pumping 200 Tons of Oil into a Battleship

exclusively for auxiliary purposes in port, is here shown taking on a supply of the heat-producing fluid. A little more than 200 tons of oil was brought alongside in the oil barge and pumped aboard in just one hour. Only three men were required to "oil ship."

The "Delaware" has been the instrument of much experiment with methods of burning oil as a substitute for coal in boilers designed for burning coal. These experiments continue, the results being very gratifying. Only a water tender and a messenger are on watch in the firerooms while burning oil, as the oil pumps do the work formerly done by firemen and coal passers. A slight adjustment of valves is all that is required to regulate steam pressure.

When a battleship burning coal exclusively is in port, two boilers are usually required to run the auxiliaries, because of the sluggish draft, while only one boiler is required with oil fuel.

Flying with an Easily Constructed Glider

Belmont, California.

Editor Popular Mechanics Magazine:

I thought that you would be interested to know that a glider, patterned after the plans which you published in your magazine, has been made and was very successful. The accompanying photograph is a picture of me as I was leaving the top of a hill. I could not get more than thirty feet above the ground, nor travel more than a hundred yards, because the hill was not steep enough. All of the better hills around here were so covered with brush that it was impossible to try flying from them.

DE RONDE TOMPKINS.

Projectile Effective as Shrapnel and High Explosive Shell

The German army has at last, according to the "Engineer," London, succeeded in producing a "universal" artillery projectile which is effective both as a shrapnel and a high explosive shell. It is designed for the 4.2-in. field howitzer equipment, and its great advantage lies in the fact that it is available for any particular nature of fire, especially against shielded guns, while the ordinary shells are each designed for a special contingency.

The new shell is, in reality, a shrapnel with a high explosive burster of picric acid in the head. It has the ordinary arrangement of bullets and diaphragm, with a driving charge in the base, but the bullets are packed in trinitrobenzol instead of resin. When the shell is burst in air by the time fuse, the flash from the fuse is led through a channel containing perforated pellets of compressed powder. This channel passes around the high explosive burster, without communicating with it, and leads the flash to the central tube communicating with the black powder charge in the base

of the shell. The bullets are then blown out in the ordinary way, except that the trinitrobenzol takes fire and burns without exploding, producing a cloud of smoke which increases the visibility of the burst. The head, with the high explosive charge, is blown off, and flies forward, bursting on striking the ground.

The fuse may also be set to burst the shell on percussion. Then the percussion part of the fuse acts upon impact, and the flash from the cap passes to a primer of fulminate, which detonates an exploder of gun-cotton powder, which, in turn, detonates the main picric acid charge. The effect is to burst the shell violently, blowing the bullets and fragments in all directions, even to the rear.

SMALL VACUUM ICE MACHINE

A little hand-worked ice machine, embodying the vacuum process of ice-making, is now being placed on the market. Briefly, the machine consists of a tested-glass sulphuric acid container in connection with an air pump, and a tube for insertion into the mouth of a decanter or other vessel. The air pump is connected with a geared fly-wheel, hand-driven. The acid container is fitted with an enameled iron cover, and the decanter is placed on a rocking holder.

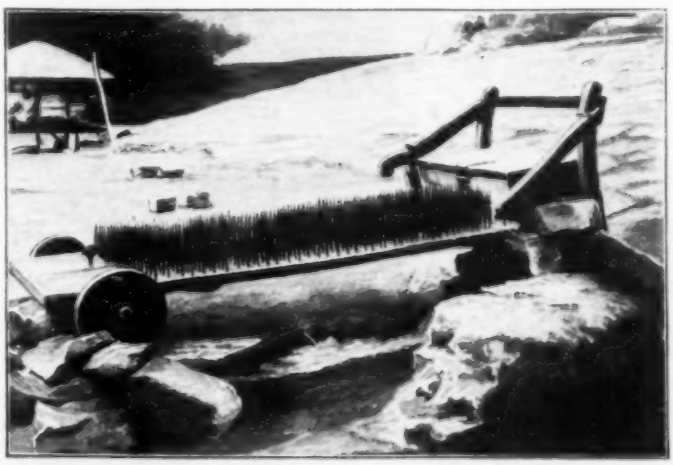
About four turns of the handle of the air pump are sufficient to give a suction

Making Ice in 1½ Minutes

that will lift the water bottle. A charge of ½ gal. of sulphuric acid will provide for about 100 operations. Ice is formed in a half-filled decanter in 1½ minutes after the handle is set in motion.

Aside from making ice, the machine can be used for the making of ice cream, for hardening butter, cooling wines, etc.

SPIKED COUCH USED BY HINDOO FAKIR



The Uncomfortable Couch of a Fakir

During the great religious festival held at the beginning of each year in Allahabad, such couches as this are often seen. They are used as resting-places by fakirs, who thus prove their piety, and as a return receive small coins from the pilgrims.

It is a curious phase of life among Eastern peoples that men who are too lazy to work are not averse to torturing themselves to gain a few pennies.

TILLING THE SOIL WITH DYNAMITE

Probably no stranger use for dynamite has ever been devised than its substitution in place of the plow for the tilling of clay land. It is being put to such a use on a considerable experimental scale in Kansas and by a planter of Spartanburg, S. C.

The first experiment at Spartanburg constituted the exploding of a stick of dynamite in each of a series of watermelon hills, and the resultant crop showed the benefit of the heroic treatment. The next experiment was the breaking up of an acre field by dynamite. The cartridges were planted 3 ft. apart, in rows, and at a depth of 4 ft. The holes were made by driving crowbars to the desired depth. The illustration shows this field planted and ready for the lighting of the fuses, which can be seen projecting from the ground.

The dynamite was exploded by a line of men, provided with red-hot irons. The line went rapidly down the field, the explosions following the men in a steady roar that was deafening. The explosions threw clouds of soil 30 ft. into the air and covered the men from head to foot with dust and dirt.

Clay land such as is found in the southern part of the country, when once disturbed to a depth of four or five feet, is said never to revert to its former solid and impervious condition. One of the great troubles of the southern farmer has been to keep the clay from puddling and holding the water on the surface of the soil.

Plowing with Dynamite—Fuses Can be Seen Protruding from Ground

PNEUMATIC CAISSON SUNK WITHOUT ACCIDENT

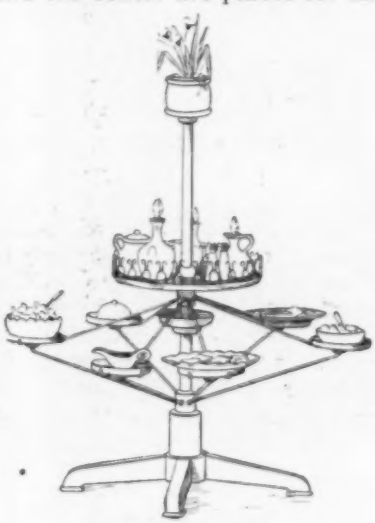
A somewhat remarkable record was recently made in the sinking of a caisson for the Municipal building, New York, during which work not one death or even accident of any kind occurred. The caisson in question is for one of the column piers, and was sunk through sand and rock to a depth of 112 ft. below water level. Its construction was commenced April 15, and the bottom was passed May 16.

The work was executed by 20 shifts, of five men each, working about 40 min. for each shift, with a long

period for decompression and an interval of four hours between the two shifts each man worked daily. The men were under strict medical supervision, improved sanitary and hospital appliances were provided, and a physician was in constant attendance. Not even a single case of bends occurred.

WHIRLIGIG WAITER FOR DINING TABLE

A device described as an automatic waiter is here illustrated. At the ends of the rods, radiating from the central standard, are holders that may be adjusted to different sizes. On these are placed the dishes to be served, while around the center are places for silver,



A Revolving Food Server

and receptacles for salt, pepper and relishes. When the food has been placed upon the waiter the guests revolve it and help themselves.

CHURCH BUILT BY ONE MAN

One often speaks of a church or some other like edifice built by one man, but the impression meant to be conveyed is usually that one man provided the funds for the structure. In this instance, however, it means that one man actually built the church, which is the only stone church in England, and

Church Erected by One Man

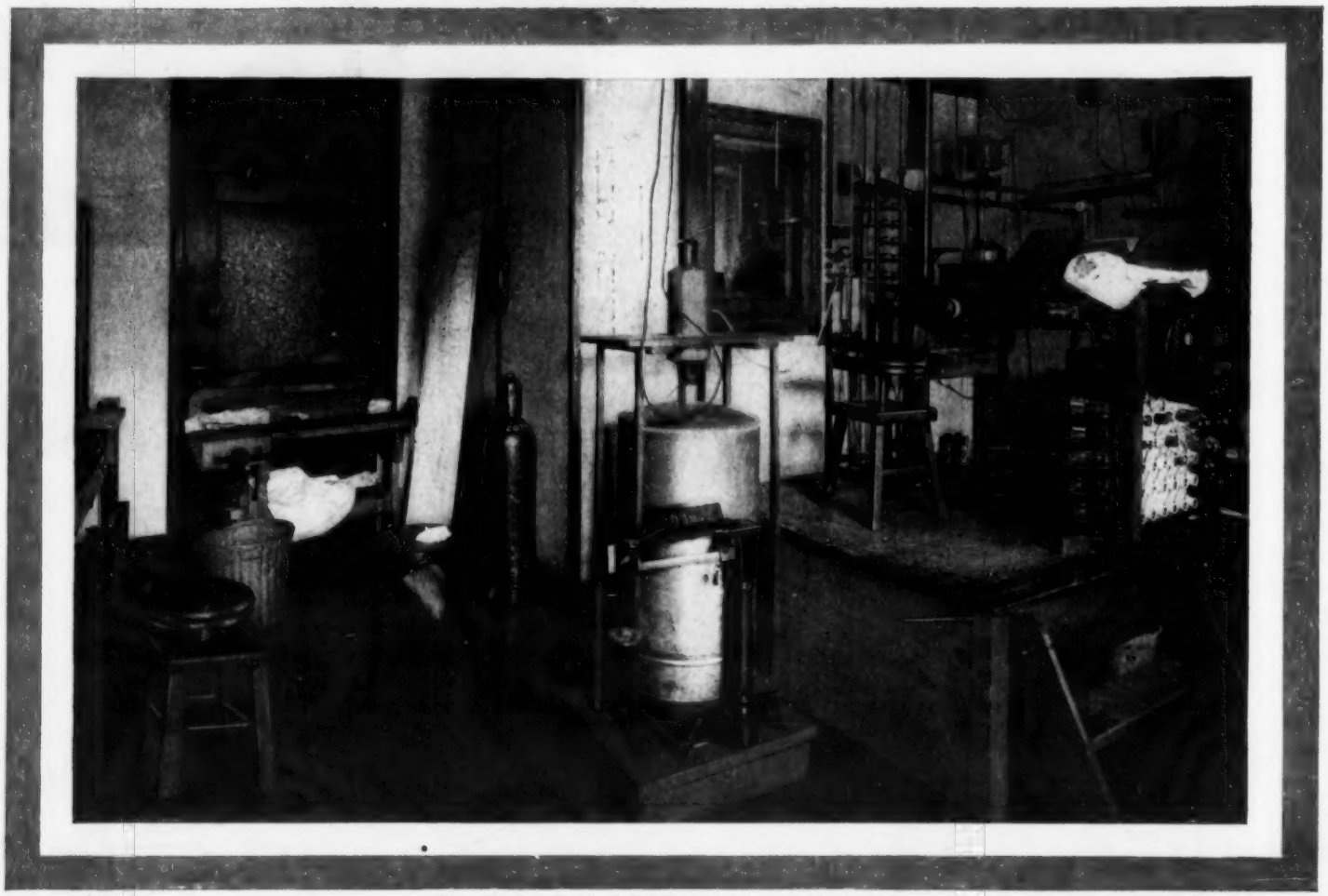
probably in the whole world, of which every stone was laid by one pair of hands.

The church is located at Stivichal, near Coventry, England. John Green, a stone-mason, laid the first stone in 1810, and completed it in 1816, during which time he had no assistance whatever, doing all the work himself until the church was ready for the interior furnishings.

HAILSTONES THAT ENDANGERED LIFE AND PROPERTY

In a storm at Calcutta a few months ago hailstones of enormous size endangered life and property. The hailstones, some of which are shown in the illustration, measured as high as 5 and 6 in. in circumference. The hailstorm was the severest that had visited Calcutta in 40 years.

Hailstones Larger Than Eggs



The "Energy Box" of the Department of Agriculture

Energy Box Determines Food Values

By W. W. RICHARDSON

WHAT is the nutritive value of eggs and toast as compared to corned beef and cabbage?

A popular vote would doubtless favor the last named combination, but would it be the correct answer?

For indisputable evidence on such questions as this the public must apply to the Department of Agriculture at Washington with its wonderful "energy box," a complicated apparatus which figures things down to a gnat's heel and never makes mistakes.

Prof. C. F. Langworthy, chief of the division of nutrition investigation of the bureau of experiment stations, is the engineer who runs the box, and he is finding out new things about food values every day. Technically the box is called a calorimeter, but those who know it best prefer the other name.

The room in which the "energy box" is built is of ordinary size and every available space is occupied. In one corner is the box, not unlike a big ice box or a miniature cold storage plant, with double doors and a double glass window on the side. Communication is had with the interior by means of a telephone. All around the walls of the box are coils of pipe filled with distilled water, the temperature of which is known to the fraction of a degree before the experiment begins. An easy chair, a table and a bicycle, suspended wheels-free from the floor, complete the fittings of the chamber.

A man enters the box, and food, carefully prepared by one of the department cooks, is passed in to him. After he has disposed of the meal the subject takes a book or magazine and seeks to keep his mind perfectly at ease. Then the scientists on the outside begin to get busy. Just under the window there is a platform with half a dozen electrical instruments on and around a desk. The observer watches all these closely, taking an occasional glance through the window at the subject.

As the food inside the man inside the box begins to digest little needles and indicators before the observer begin to move. These movements are caused by the rising temperature of the water in the coils of the box, and the heat which causes it comes from the subject's body.

The experiment is finally finished and the observer has in his possession evidence which no one will dare contradict that caviar and Roquefort cheese produce more heat energy than charlotte russe and fudge or maybe the other way. And so the experiments continue from day to day with variations. Today the subject rests after his meal, tomorrow he mounts the bicycle and reels off mile after mile at top speed. Another day he reads mentally restful fiction. At still another time he solves mathematical problems, and thus the process of mental and physical rest and fatigue goes on in order to have recorded with scientific accuracy just the amount of energy developed by various foods, and whether they produce more of this force in a man engaged in active pursuits or sedentary occupations.

The observer's real work begins when he undertakes to tabulate the results. The apparatus has been built up as the result of several years of experimental work by the experts of the Department of Agriculture, and is a model of scientific accomplishment.

YOUNGEST AERONAUT IN FRANCE

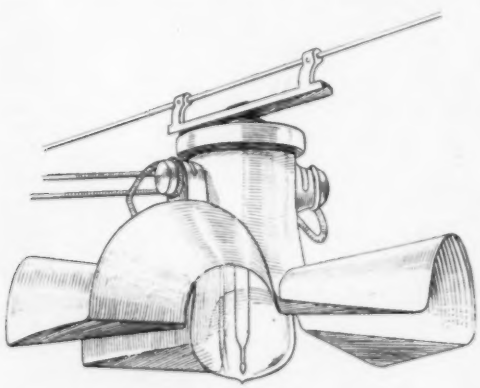
Little Mlle. Etiennette Querbes, a French girl not more than 12 years of age, is called the youngest "air-child" in the world. She has been provided with a Santos-Dumont monoplane, especially constructed for her use, and has flown over short distances on several occasions at Drancy, France.

STAGES IN FIGURE STENCILING

Red Proof | Brown Proof | Gray Proof | Composite Proof

ELECTRIC-LAMP REFLECTOR FOR INTERSECTING STREETS

By means of a porcelain enameled steel reflector, composed of four intersecting semi-parabolas surrounding the lamp, the globe type of electric street lamp is made to cast the greater portion of its light down the centers of the intersecting streets, and only the minimum amount reaches the street corners. When the fixture is suspended



Shade Throws Light Down Center of Street

in the center of a block, a reflector with only two, instead of four, semi-parabolas is furnished, thus stretching the light out considerably.

METHOD OF PICTORIAL STENCILING

The accompanying illustration shows the four stages in the stenciling of a mural decoration, known as "The Pilgrim's Way," by Herbert A. Bone. The completed panel includes a landscape and several figures on foot and on horseback. The figure here illustrated required three stencils in red, brown, and gray. The first three drawings show the red, brown, and gray proofs, and the fourth the composite proof.

Each figure required several special stencils, as did the scenic decoration. How Mr. Bone set about making his stencils for the piece is here given in part as explained by him in the International Studio:

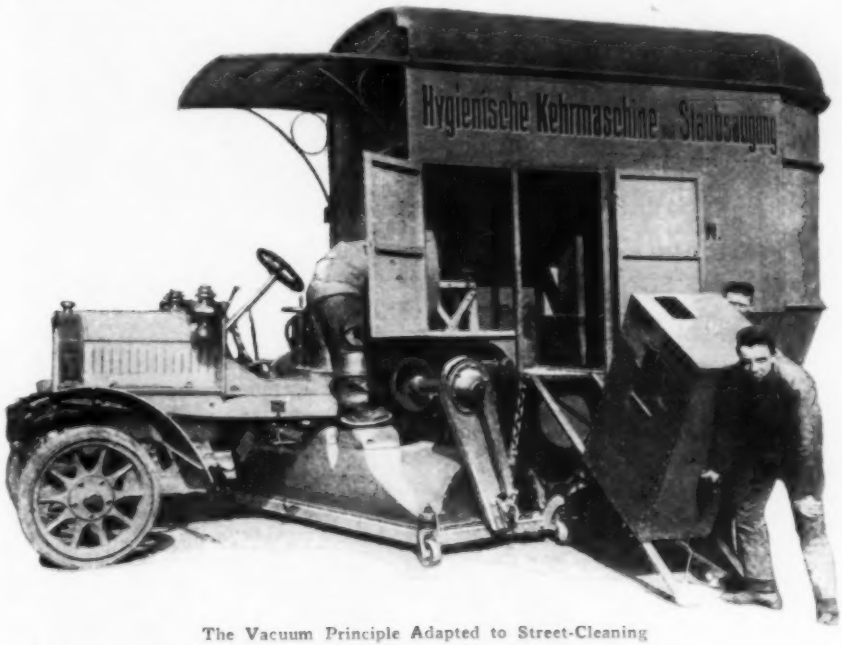
"I first cut a series of figures, and independently, a repeating landscape, in stenciling which the figure contours were screened and kept blank by movable silhouettes. The trees were separately silhouetted and stenciled, and the sloping bank required still another set of plates. This process, in repetition, gives a free hand for spacing and redistribution. The subject permits, for all the figures are on the same errand, a rearrangement of the company now

and then, and a re-appearing differently grouped. The trees being also free, can be made to divide the frieze into panels of any length, thus adapting it to walls of any plan, with continual variety of combination.

"In operation, a paper copy of the landscape is fixed over the canvas stretched upon the table, and upon this the silhouettes of trees and figures are arranged at will. This done, the silhouettes are all pinned down, through register holes corresponding to those in the stencil plates, the paper background withdrawn, and in its place the landscape plates are worked off, over the silhouettes. The broad tints of the hillside are brushed without a plate (which their expanse renders unnecessary), around the silhouettes, and these, acting as an internal stencil, preserve a white contour against the tinted background, which, by its continuity, regulates the subsequent evolution of the color scheme. Where figures are massed, some partly hiding others, the silhouettes are filled after stenciling the background, note being taken of their register holes in the canvas, into which they are again pinned in reverse order, those of the nearest, underneath; those only partly visible, above. Beginning with the last, the stenciling proceeds, silhouettes being peeled off and stencil plates substituted until the lowest layer is reached, when their contours will be found intact for stenciling in full."

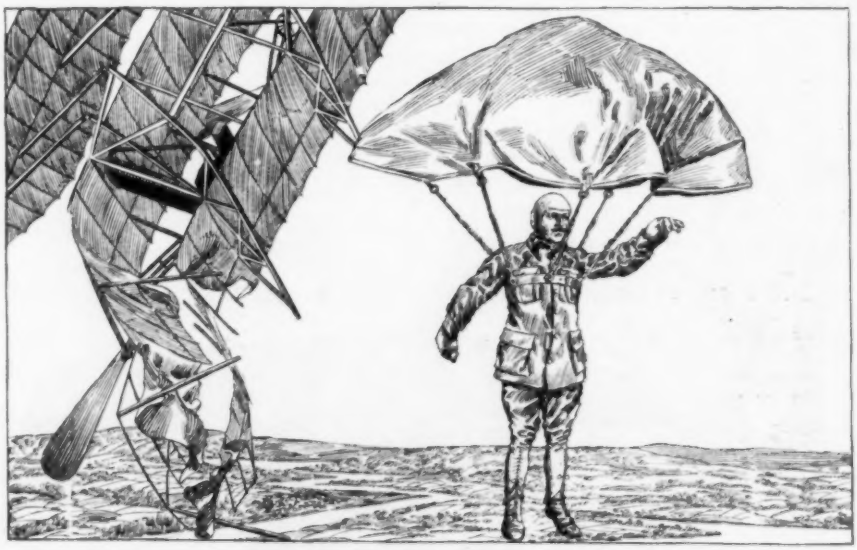
VACUUM STREET-CLEANER

A Vienna engineer has constructed a road-cleaning automobile that embodies the principle of the vacuum cleaner with that of the ordinary street sweeper. A rotary brush, operating under a hood, turns up the dust, which is drawn up through the hood by a strong suction of air and deposited in a metal box. When the box is filled it is removed from the machine in the manner shown in the illustration. The suction funnel and the hood covering the rotary brush can be clearly seen.



The Vacuum Principle Adapted to Street-Cleaning

¶An English railroad is running what are called "egg trains," which carry lecturers who advise the farmers how to conduct the poultry business on a profitable basis.



Aviator's Parachute Extended for Action

PARACHUTE HEAD-DRESS FOR AVIATORS

A parachute that is to be worn over the head of an aviator, with folds hanging down back of his shoulders like a woman's mourning head-dress, but which spreads out in parachute form should the aviator fall, is here illustrated. It is attached by chains to a belt which passes around the body just under the arms. At the moment of the fall it spreads out, and the aviator drops safely to the ground, provided, of course, he escapes becoming entangled in the falling machine.

Aviator's Parachute Worn as Hood

BROOM-CORN ENCOURAGED IN ARGENTINA

When the shortage of broom-corn became apparent in this country, one of the Western concerns handling the product sent one of its men to South America in search of the much-needed brush. He had heard of the fine qualities of broom-corn raised in Argentina, but on arriving there found that the crop raised was not much more than 300 tons.

Accordingly, he

started out to encourage the culture, telling the farmers of the shortage in the United States, and distributing about 100 bushels of seed among them. The growing season in Argentina is just opposite to that of this country, planting time being in September and October, and harvest in February or March. As a result of the man's activity, the crop will probably be boosted to 600 or 800 tons at the next harvest.

RADIUM INJECTIONS AS DISEASE CURE

The injection of solutions of radium into the human body is now being tested as a curative measure by French physicians, while scientific men of the other European countries are watching with much interest. Two cases of lupus and one of cancer have been cured, according to an article in the London Lancet, and much hope is offered for the future.

When introduced into the body the emanation diffuses itself through the structures and may in this manner reach deep seated parts. It has a predilection for the glands which form an internal secretion. The soluble radium is in a free state when injected into the body and carries with it the gaseous emanations which give rise to the phenomenon of radio-activity.

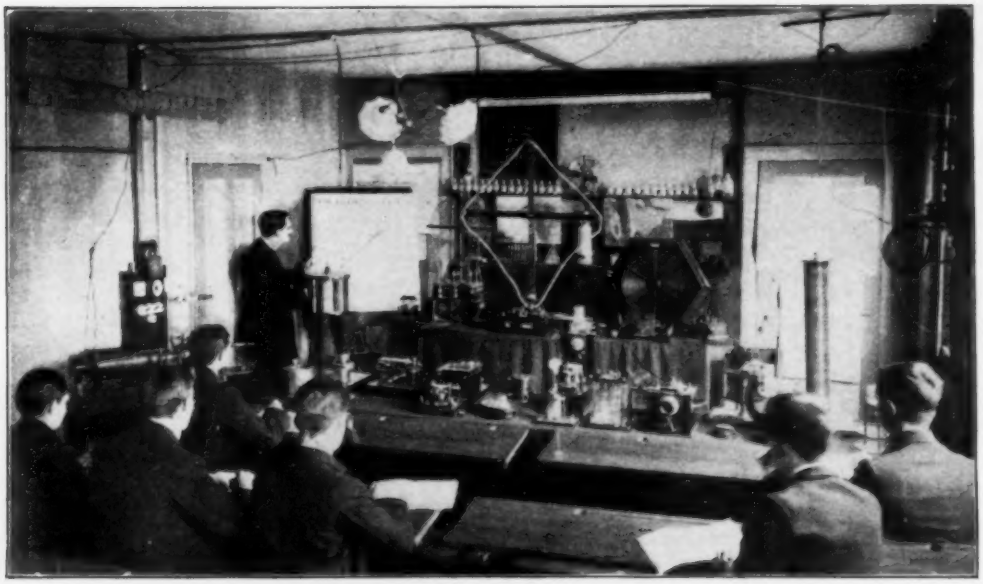
In one of the cases of lupus the lesions on the left side were treated by the application of the radium apparatus and those on the right side by injections. On the left side there was a sharp reaction with the destruction of the lupus and a subsequent process

Roller Skating on a Berlin Pavement

SAILING ON ROLLER SKATES

Sailing on roller skates has now become one of the most fascinating of sports for the younger generation in Berlin. There is hardly a section of the German capital where there are good pavements and comparatively little traffic but a group of boys with at least one sail may be found. The sail is of the same type that has been used by ice skaters for many years. With a good wind it is possible to spin along the pavement at a high rate of speed.

¶Tungsten salts are now used in fireproofing cloth for curtains and draperies.



Wireless Telegraph Schoolroom

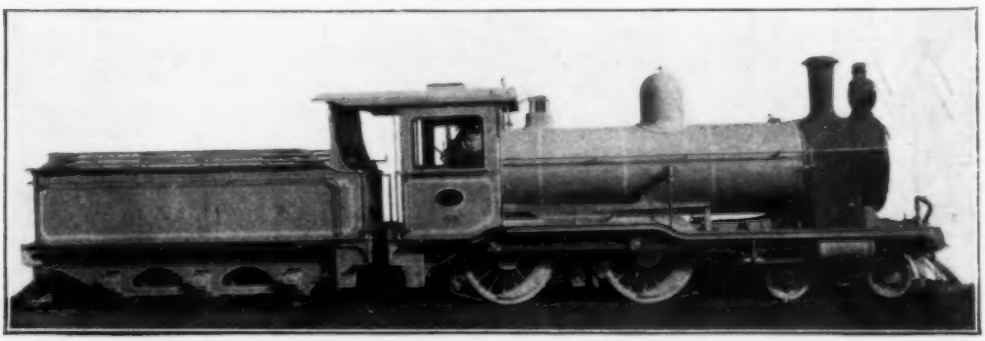
of repair. But still later there was a recurrence of the lesion at the margin of the tissues of repair. On the right side there was no visible inflammatory reaction, but there was first a diminution and then a disappearance of the lupus. At the time the recurrence was found on the left side the recovery on the right side was maintained and there has been no reappearance of lupus since.

INTERIOR OF WIRELESS TELEGRAPH SCHOOL

This illustration gives an excellent idea of the kind of a schoolroom in which wireless telegraphy is taught. It is part of a large school of wireless, submarine cable, and ordinary telegraphy. The apparatus in the room represents the various systems, and is used by the students in practical and experimental work.

AN AFRICAN LOCOMOTIVE

The accompanying illustration shows the type of passenger locomotive used on the British railways in South Africa. It has two 5-ft. driving wheels on a side and weighs 43 tons. The tender, the forward end of which forms the back of the cab, weighs 31½ tons.



Passenger Locomotive on African Railway

HEAT

Part VIII—Expansion and Contraction

By J. Gordon Ogden, Ph. D., Professor of Physics, Fifth Ave. High School, Pittsburgh

[This is the eighth article of a series by Dr. Ogden, in which well known subjects will be discussed from the standpoint of their relation to modern mechanics. The following subjects were discussed in the months indicated: February, "The Nature of Heat and How It Is Measured;" March, "How Low Temperatures Are Produced;" April, "Some Effects of Low Temperature Upon Matter;" May, "The Production and Uses of High Temperature;" June, "High Temperatures and the Rare Metals;" July, "How Heat Travels;" August, "How Heat Is Measured." Succeeding articles will include Steam, Boilers, Ice, Radiation, etc.]

EXPANSION is one of the most remarkable of the phenomena to be reckoned with in the natural world. Practically every bit of matter from the Great Brooklyn bridge to the tiny hair-spring in one's watch is under its imperial domination. It is a tremendous force, and the world of mechanics has to treat it with the deference and respect due to its gigantic power. Unlike gravity, and other forces of nature, it is whimsical, and takes sudden fits and starts, now acting one way, now another. It affects different bodies in different ways, and seems to be at variance with the time-honored forces whose action can be predicted under all circumstances. At least that is what it apparently does. In our meager knowledge of the great underlying laws that control the universe, it is possibly unwise to speak so unkindly of expansion, as though it were a spoiled child in need of correction; its behavior, however, is so contrary to what one might expect, that one is at a loss to say anything else.

Take for example the peculiar action of heat upon water. A pint of water at, say, the boiling point, 212° F., occupies a certain definite volume. Allow it to cool, and the volume steadily shrinks until it reaches the temperature of 39° F. If the temperature of the water be lowered below that point, contrary to all expectation and understanding, the water begins to expand and will continue to do so until it reaches the freezing point. In other words, a pint of water at 39° F. is heavier than a pint of water at any other temperature. Why? We do not know. It is one of the peculiarities before referred to.

Of course, it is a good thing for us that water does not freeze at its point of greatest density. If that were so, ice would form at the bottom instead of the surface of a pond, and the rivers in the Temperate zones would become

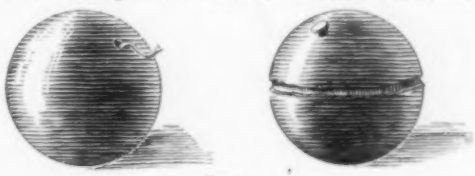


FIG. 1
Bombs Burst by the Expansion of Freezing Water

literally solid masses of ice which the summer's heat could not melt, being protected by the non-conducting water above. This would go on, year after year, until practically the whole continent would become a mass of ice. It might appear at first thought that nature had designed this phenomenon with reference to man's convenience and comfort, but, as Tyndall pointed out years ago, the same peculiarity is true of other substances besides water, as iron and bismuth both expand upon freezing, and solid iron will float in liquid iron, even as ice will float in water.

The force exerted by water in crystallization is enormous. As shown in Fig. 1, thick shells of iron filled with water will break like piecrust when the confined water freezes. We are, unfortunately, on familiar terms with the plumber during the winter season on this account. Some years ago an ingenious device was patented by an English surgeon to obviate the usual results of the freezing of water in exposed pipes. A rubber tube is placed within a water pipe and of such diameter that the space inside the tube is a little more than equal to the increase in volume of the water by freezing.

The rubber tube is filled with air, and when freezing takes place, and consequent expansion, the air will be compressed instead of the pipe being split asunder. Another wrinkle, just as simple, consists in pounding or compressing exposed lead pipes until they assume an elliptical shape. The expansion due to the freezing of the water will cause the pipe to re-assume the circular form, and thus allow for the increased volume required by the ice.

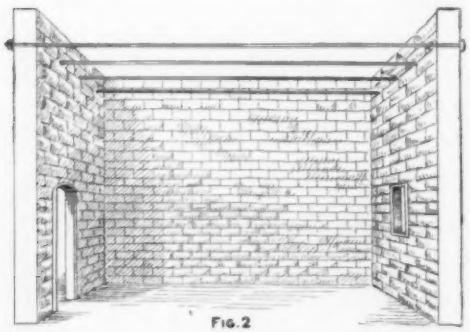


FIG. 2

Rectification of Walls by the Contraction of Iron Rods

About the only reasonable hypothesis which will explain the changes in volume caused by freezing and melting is that of Tyndall, who assumed that the molecules of a body are really little magnets, and that the attraction and repulsion of these magnets causes them to form combinations that occupy more or less space, even as a thousand bricks could be arranged in a multiplicity of ways. This theory also explains, to a degree at least, the fact that wrought iron, iron wire, and cast iron, have different rates of expansion.

Certain crystals, such as the emerald and Iceland spar, when they increase in length in one direction, contract in another. Rubber and iodide of silver are also exceptions to the general law that heat causes expansion, while the absence of heat causes contraction. Dried wood has not the same expansion rate in the direction of the fibers, and perpendicular to their direction. Clay, even when completely dried, will contract when it is submitted to an increasing temperature, and advantage is taken of this peculiar fact in the construction of clay pyrometers for the determination of the temperature of large kilns.

The expansion rates of platinum and glass are practically the same. Upon this fact depends one of the world's great industries, the manufacture of incandescent electric-light bulbs. The current passes the glass walls of the bulb by means of tiny platinum wires, and these wires contract and expand at almost exactly the same rate as the enveloping glass. If this were not so, a vacuum could not be preserved in the bulb, and the delicate filament would be oxidized almost as soon as the bulb warmed up. A fortune beyond all comparison lies within the grasp of the lucky individual who will provide a substitute for the platinum, as platinum is quite rare and expensive, and something must be done soon, owing to the limited supply of this metal in sight.

The walls of a building are sometimes rectified by the enormous force exerted by the contraction of iron rods. Bars of iron are placed so as to join the two walls where the bulging is most pronounced. These bars terminate in screws furnished with nuts. The whole of their length is heated and the nuts tightened. On cooling, the bars will contract with practically irresistible force, causing the walls to straighten up. This operation is repeated until the rectification is complete. Boiler plates are fastened with red-hot rivets. The contraction of the rivets incident upon their cooling draws the plates tightly together, forming a steam-proof joint.

Tyndall, in his work on heat, gives an excellent illustration of the force of expansion and contraction. "The choir of Bristol Cathedral was covered with sheet lead, the length of the covering being 60 ft., and its depth, 19 ft. 4 in. It had been laid in the year 1851, and two years afterwards it had moved bodily down for a distance of 18 in. The descent had been continually going on from the time the lead had been laid down, and an attempt to stop it by driving nails into the rafters had failed;

for the force with which the lead had descended was sufficient to draw out the nails. The roof was not a steep one, and the lead would have rested on it forever, without sliding down by gravity. What, then, was the cause of the descent? The lead was exposed to the varying temperatures of day and night. During the day, the heat imparted to it caused it to expand. Had it lain upon a horizontal surface, it would have expanded all around; but as it lay upon an inclined surface, it expanded more freely downward than upward. When, on the contrary, the lead contracted at night, its upper edge was drawn more easily downward than its lower edge upward. Its motion was, therefore, exactly like that of a common earthworm; it pushed its lower edge forward during the day, and drew its upper edge after it during the night, and thus by degrees it crawled through a space of 18 in. in two years."

A Prince Rupert drop, or Dutch tear, is a curious and familiar example of the effect of contraction and expansion. Melted glass is dropped into ice-cold water and a small, pear-shaped mass of glass shown in Fig. 3 is formed. The rounded end is hard and tough and will resist considerable pressure. If the filament end, however, is broken, the whole mass will immediately disintegrate into a fine powder with explosive violence. If the operation be performed in a flask filled with water, the shock will be sufficient to break the flask. The explanation is simple. The drop of hot glass is suddenly cooled, and a thin skin of cooled glass is stretched tightly over the body of the drop, inclosing the interior mass which has not had time to solidify. When this interior mass does cool, it produces a state of intense strain. The effect of the contraction is exercised equally on the whole mass, and, notwithstanding the strain, the drop remains in equilibrium. This equilibrium, however, is instantly destroyed when any part of the drop is fractured, and the unbalanced strain causes the drop to fly to pieces.

Mention has been made in a preceding article of the effect of unequal expansion upon two different metals that have been bolted together. It is by this principle that the action of the ordinary thermostat, so familiar now as a controller and regulator of the temperature of large buildings, is explained. This device is shown in Fig. 4. R is a rod made up of two different

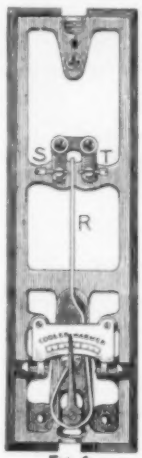


Fig. 4
Ordinary Thermostat

Fig. 3

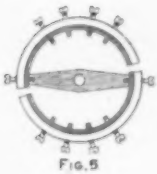


Fig. 5
Dutch Tear Balance Wheel

Fig. 6
Gridiron Pendulum

metals whose rate of expansion are different. When the temperature of the room in which the thermostat is placed becomes too high, the rod curls toward the metal point S and touches it, completing an electrical contact, which causes a motor to shut off the draft. When the temperature of the room falls below a certain point, the rod curls in the opposite direction toward the metal point T. This causes a motor to open the draft and thus furnish a more abundant supply of hot air.

Everybody, in these days of cheap and reliable timepieces, carries a watch. And yet there are very few who appreciate the methods and devices by means of which the troublesome expansion and contraction of metals are corrected, in order that a watch may keep correct time. The balance wheel of a watch corresponds to the pendulum of a clock, and any variation in its dimensions will cause it to move faster or slower, as the case may be. The hair-spring is really a long strip of metal which becomes weakened in its effect when expanded

by an increase in temperature, and has its power augmented when contraction takes place.

To correct both of these conditions, the rim of the balance wheel is made up of two different metals, the outer part

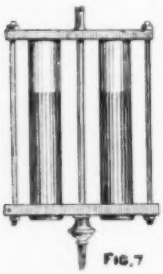


FIG. 7

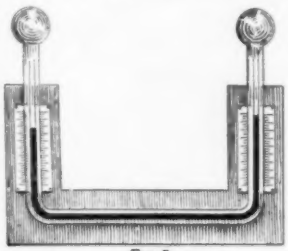


FIG. 8

Mercury Type of Pendulum and Leslie's Differential Thermoscope

brass, the inner part iron. See Fig. 5. When the hair-spring becomes weaker by expansion, the brass of the balance wheel also expands; but as it expands more than the iron to which it is bonded, it curls in toward the center of the wheel, making practically a wheel of smaller diameter, and causing the same effect as is produced when a clock pendulum is shortened. Exactly the opposite conditions obtain when the timepiece is exposed to extreme cold, and the balance wheel has its diameter increased, thus causing a slowing up to counteract the increased strain produced by the contraction of the hair-spring. The same principle is applied in the construction of first-class clocks. Any uncorrected variation in the length of a pendulum is fatal to the timekeeping quality of a clock. A gridiron pendulum (Fig. 6), made up of alternate rods of steel and brass, serves to correct the result of the expansive force. The central steel rod passes through holes in the lower horizontal framework, and supports the bob at the lower end. The steel rods are so arranged that they will expand downward, while the brass rods expand upward, and the total length of each metal used is exactly sufficient to counteract each other's expansion, and the center of the bob will remain at a constant distance from the point of suspension.

Figure 7 is a representation of the mercury type of pendulum. The rod to which the bob is attached expands downward while the mercury in the two compartments expands upward. By careful experimentation the exact quantity of mercury necessary to preserve an even balance may be determined. Of course, the gross length of the pendulum varies, but as the real length of a pendulum is the distance from its point of suspension to its center of gravity, in the mercury type of pendulum, the center of gravity remains constant.

The metallic thermometer already referred to in a former article is an ingenious device whose action depends upon the principle that different metals have different rates of expansion. As this thermometer was fully described, its explanation will be omitted here. Leslie's differential thermoscope (Fig. 8) consists of two bulbs connected by a tube containing colored sulphuric acid. If one of the bulbs be warmer than the other, the acid will move toward the cooler bulb, due to the expansion of the air in the warmer bulb. This thermoscope is extremely sensitive to temper-

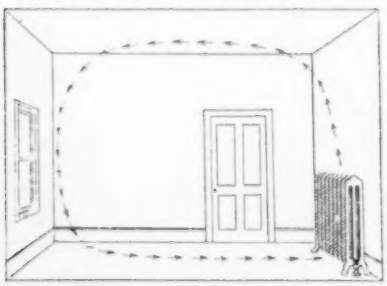


FIG. 9

The Circulation of Air in a Room Heated by a Radiator

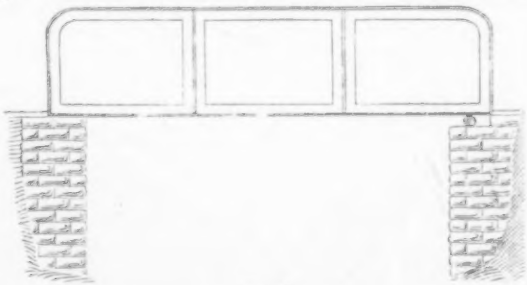


FIG. 10

Roller (on right) Providing for Expansion of Iron Bridge

ature differences. Rumford's thermoscope acts upon the same principle as Leslie's, but has a longer horizontal arm, and contains alcohol instead of sulphuric acid.

Owing to the fact that gases expand much more than solids or liquids, the balloonist who seeks the higher altitudes is in considerable danger. The hydrogen gas or coal gas with which his balloon is filled expands under the influence of the unobstructed rays from the sun and also on account of the lessened atmospheric pressure. Instances are on record showing that balloons have burst from these causes. The United States Weather Bureau sends up into the higher reaches of the atmosphere large numbers of what are termed "sounding balloons." These balloons carry automatic registering apparatus for recording certain data of the aerial ocean. At a certain altitude the rubber bag containing hydrogen bursts, due to the expansion of the gas, and the instruments descend by means of a parachute to the ground.

The contraction of a gas by cooling causes a balloon to become flabby and unwieldy. This is corrected by means of a second bag, called a "ballonet," which is placed within the main balloon, and may be inflated with air by means of a motor, thus maintaining the shape of the balloon. When the hydrogen expands to the danger point, the volume of the balloon may be regulated by letting the air in the ballonet escape through easily controlled valves.

The most important industrial application of the fact that gaseous bodies will readily expand and contract is in the matter of ventilation. Hot air rises. Cold air falls. By taking advantage of these facts, the problem of proper ventilation is easily solved and a steady circulation of air insured, as shown in Fig. 9.

TARGET FOR FISHERMEN'S CASTS

The international competition for fishermen in the Bois de Boulogne, Paris, brought to light a very curious water target. The target floats on the

Water Target Used in International Fishermen's Competition

water, as the illustration shows, and each section of it is numbered. There is also a measure, stretched along the surface. The contesting anglers, provided with high rubber boots, stand in the water back of the measure, and cast at the target.

NO SMOKING LAST HALF OF DAY IS FIRE PRECAUTION

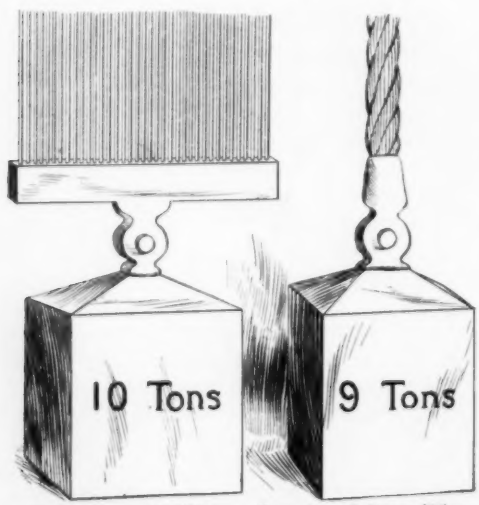
Hanging on the office walls and in the factory of an eastern manufacturing concern are signs which prohibit smoking after one o'clock in the afternoon. The question asked by those who see the signs for the first time is why the employes should be allowed to smoke one part of the day, if not the other part.

Some time ago the manager experimented to find out what time would elapse after the throwing of a lighted cigar or cigarette into different dangerous places before a fire was well started. The results demonstrated that not more than five hours elapsed in most cases before a healthy flame developed. Therefore the manager took five hours as the limit of danger and stopped all smoking at one o'clock, so that if carelessness were to result in fire it would be discovered before the closing hour.

WIRE MADE INTO ROPE LOSES STRENGTH

The method employed in measuring the breaking strength of wire rope has hitherto been based upon the individual wires in the rope, but this, as the two illustrations attest, overestimated the strength of the rope they are formed into.

In one illustration, a 10-ton weight is being supported by 42 wires, and in the other, the same number of wires laid into a rope are supporting only 9 tons. The reason for the loss of one ton, according to the American Wire Rope News, is because of the indirect pull upon the wires and, further, because all the wires are not always under the same stress at the same time.



Capacity of 42 Wires — Capacity of Same Wires Made into Rope

STEAM MOTOR TRUCK OF 20-TON CAPACITY

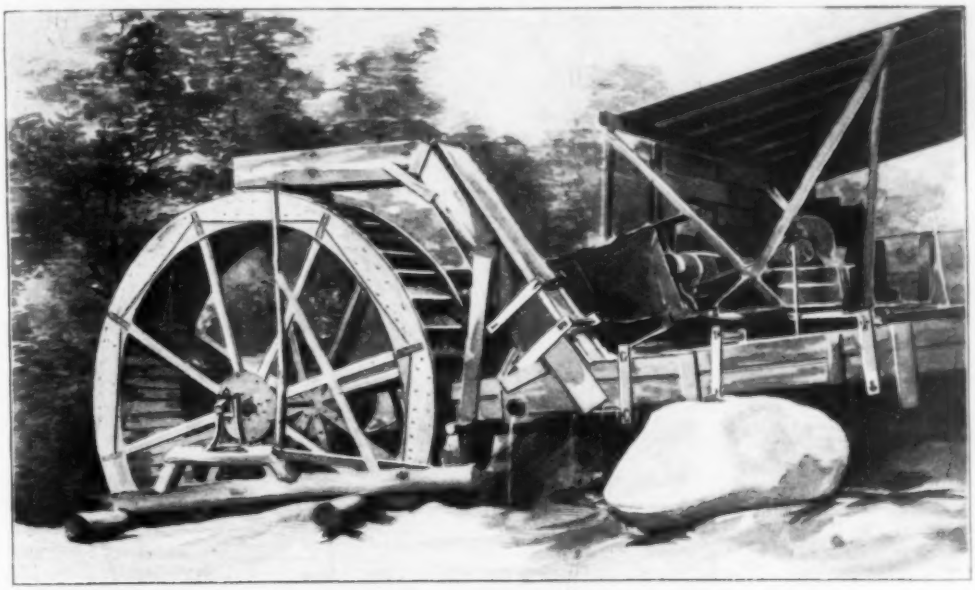
A powerful steam-driven motor truck, burning a specially selected combination of hard and soft coal as fuel, has been built by a large structural concern of Chicago as a vehicle for the transportation of long and heavy beams, girders, columns and other structural material through the streets.

Ingenious Motor Truck Carries 20-Ton Load

A vertical inverted marine boiler supplies the motive power. It is rated at 30 hp., but can develop 40 hp. when working at its full capacity. Steam is supplied by a marine water-tube boiler with a heating surface of 330 sq. ft. The special combination of hard and soft coal gives no smoke and shows only a brown vapor. The exhaust steam passes through a muffler. The machine carries about half a ton of coal and a water supply of 260 gal.

The length of the machine is 32 ft., and its carrying arrangement consists of a pair of 10 by 12-in. fir beams or sills supported at a considerable height above the ground by bolsters resting upon the axles. Across the sills are two shafts, provided with ratchets and levers supporting the chains by which the load is suspended. The steering seat and wheel is mounted about half way back on top of the sills. The driving machinery is in the steel cab over the rear wheels. The illustration shows the machine transporting a long steel column. The carrying capacity is 20 tons, and the weight of the machine, light, is 12 tons, making a total of 32 tons when loaded. The average speed

when loaded to capacity is about 1½ miles an hour. It occupies less length of street and is more easily handled than the ordinary vehicles used for the same purposes, drawn by 6, 8, and 10 horses.



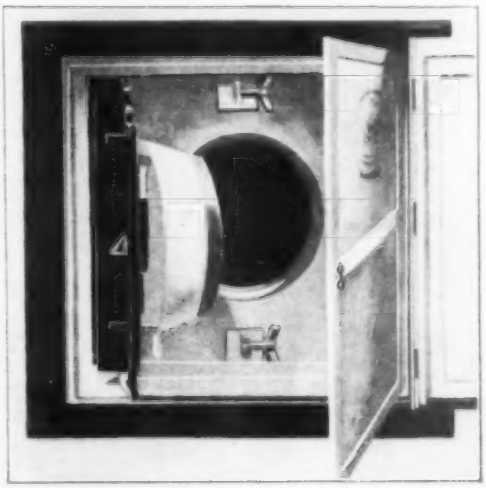
Waterwheel Provides Power for Massachusetts Home

WATERWHEEL LIGHTS HOME AND RUNS MACHINERY

The overshot waterwheel shown in this illustration is not a relic of early days, but a modern home-made wheel built by Arthur Scott, of Woronoco, Mass., to furnish him with power for several home tasks. The wheel is 14 ft. in diameter, and drives a 110-volt generator, which furnishes sufficient electricity for fifteen 16-cp. lamps in his home. He also uses the wheel to furnish power for running the laundry, sawing wood, and turning a grindstone.

THE RADIUM SAFE

The safe recently built by the British Radium Corporation was described in a recent issue of this magazine. Accompanying is a photograph of the wonderful depository. Steel is, of course, powerless to confine radium emanations, since they pass through the thickest armor plate as readily as sunlight passes through plain glass. Lead is the only metal which radium cannot penetrate, and the safe was, therefore, lined with it. To prevent the loss of the radium emanations when the safe is opened, two valves have been inserted and tubes containing mercury are passed through before the door is unlocked. These tubes collect and store the emanations.



Can Hold Five Billion Dollars' Worth of Radium

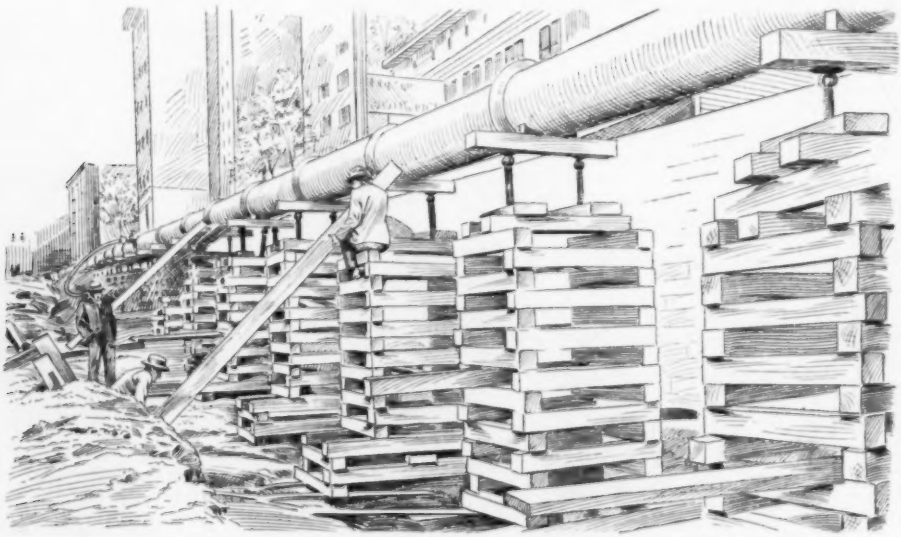
SMALL CHURNS FOR CITY HOMES

There seems to be no reason why the city dweller should not follow the example of the farmer in making his own butter. Cream, it is true, is much higher in the city than in the country, but so is butter. With such a churn as this the housekeeper can take the cream which sours and is otherwise often wasted and turn it into a pound or half of butter in from two to five minutes.

RAISING QUARTER OF A MILE OF WATER MAIN

In the course of the work of grading the city of Seattle, Washington, one of the streets, Western avenue, was filled in and raised 17 ft. It was necessary to raise 1,400 ft. of 20-in. water main the same height, and the task was an extremely delicate one, for the work had to be done without interfering with the water service. An expert house mover was called in and by means of hundreds of jackscrews, the big main was lifted from its bed and hoisted into the air. Water was carried at a pressure of 130 lb. to the square inch during the work, but not a joint was broken nor a drop of water spilled.

The city is now laying a 20-in. supply main to the West Seattle district where the engineers have been confronted with a situation which requires submarine work. The mouth of the Duwamish river will, at a later date, be diverted into what is platted as the West Waterway, and rather than go to the expense of building an additional trestle for temporary use, the pipe is being laid on the river bed. Four hundred feet of main will be laid under water, divers doing the work. Two 12-ft. lengths of pipe are coupled together at the surface and lowered to the river bottom, where divers, working in a trench dug in the silt by a suction pump, bolt the sections into one continuous pipe. The ends of the 24-ft. sections are equipped with flexible joints, allowing the main plenty of "give" in the settling which is expected to follow before it reaches its final resting place.



Jacking Up a Water Supply

Grabbing the Government Oil Lands

Petroleum Lands Entered on Fraudulent Claims of Gypsum Discoveries. The Agents of Uncle Sam Look the Other Way While Valuable Fields Are Seized—Inadequate Land Laws the Cause, Yet Congress Fails to Provide the Remedy.

By Guy Elliott Mitchell

WHO would expect to put gold and silver in the same class with natural gas and petroleum? Since oil and gas are not vegetables, nor yet animals, they are perforce minerals, and as such, if a man wants to locate either of them on the public lands, he must do it under the gold placer law.

Doubtless, when the placer mining law was enacted no one in Congress had any idea that it would ever be required to cover the location of mineral deposits such as oil and gas. Yet when oil was found on the public lands, there was no other law under which it could be located, nor is there today. One great reason for the land frauds which have persisted in the West is faulty and inadequate land laws. The laws have invited fraud and in fact have made it almost necessary, if men were to keep up with the procession.

The principal reason, and it is a good one, for the fraud and the evasion of law in oil locations lies in the fact that the basis of a location under the placer mining law is discovery. In the case of oil actual discovery can be stated only after the drilling of a well, an expensive proposition. Moreover since oil flows willy nilly, an adjoining claim may pump out the oil originally underlying the land of the discoverer.

Fanciful Workings Under a Gypsum Claim to Obtain Title to Oil Lands

The consequence is that as soon as

oil is actually discovered in any field every bit of adjoining public land is filed upon under one pretext or another and in many cases simply held without development. That the government should have thus far administered its great petroleum property, worth billions of dollars, under such an absurdity as a gold-placer law shows how wise and up-to-date Congress can be.

A favorite method in some of the California oil fields has been to enter the land, claiming discovery of other minerals, notably gypsum. Numerous

Artistic Trench-Work Used to Evade the Law and Secure Oil Lands

trenches are more or less artistic and fanciful methods of assessment work, done to obtain title to the land, with posted notices, can be seen in the various oil regions. The gypsum, however, on most of the claims is conceded to be of little or no commercial value and as stated in a recent report of the United States geological survey, the entries are simply "blinds" to control the lands for their oil values. Many of the examples of the assessment work are so picturesque as to suggest the fact that the entryman was intent upon deriving as much amusement as possible out of the farce, for himself and the community. The letter of the law, however, under these gypsum entries is probably complied with and the oil entrymen have assumed that in their gypsum "discoveries" they had found a plan of milking Uncle Sam which was so easy and sure, and withal so eminently safe, that they could laugh aloud about it.

But these and other considerations have caused a recent withdrawal from all forms of entry by the Department of the Interior of over 3,000,000 acres of these known public oil lands in California, Utah, and Oregon, pending legislation by Congress to provide for legitimate development of oil and gas lands. In the vernacular, it is now up to Congress to act.

A recent statement of the geological survey expresses the belief that a well-considered leasing law will provide the best method of handling oil and gas deposits by enabling the government to require development work in such manner as to prevent much of the criminal waste now prevalent. In this connection it is stated with significance that the government is not only the largest owner of oil lands at the present time,

but that it is likely to be the largest consumer. The six great Dreadnought battleships in commission and under construction in the American Navy are equipped for the use of both oil and coal and the fourteen largest Destroyers use oil exclusively. The question of fuel-supply by these vessels is certainly an important one and for this reason alone it would seem that the government should intelligently meet the question of the management of its great petroleum properties.

COMBINED OPEN AND CLOSED TRACTION CARS

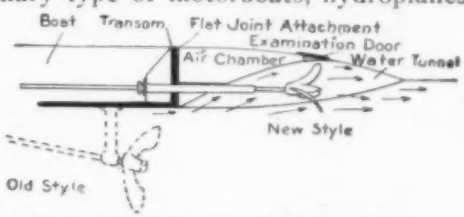
In nearly every part of the country where electric street railways exist people are familiar with the open and closed cars used at different periods of the year, but the car shown in this illustration is a type developed to fit the climatic conditions of the Pacific coast.

In southern California, especially, the climate is so mild throughout the year that at certain hours almost every day an open car is desirable, but a closed car is just as much of a necessity after sundown. Consequently, the car in general use in California has a central closed compartment, while both ends are open.

The closed section of the car shown in the illustration, which is used on the Fresno system, has eight transverse seats upholstered in rattan. The windows are of the usual drop sash variety. The open sections of the car have wood slat seats.

PROPELLER-TUNNELS FOR SHALLOW-DRAUGHT VESSELS

This illustration explains the construction of a high-speed shallow-draught tunnel designed for the ordinary type of motorboats, hydroplanes

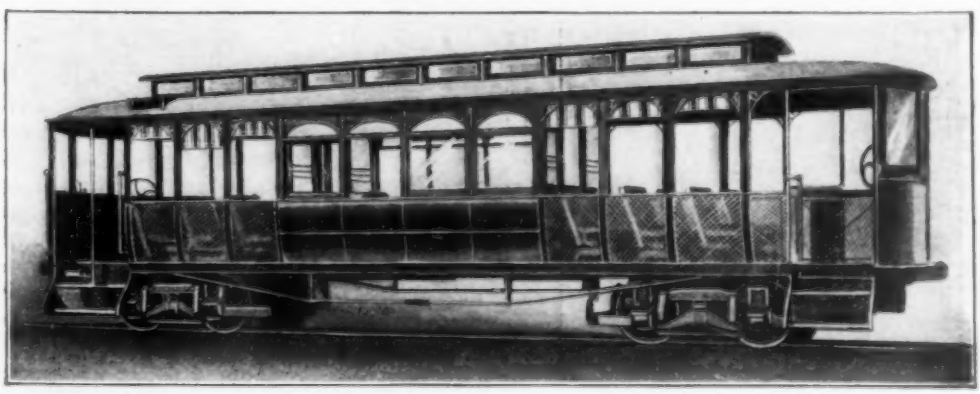


Comparison of Tunnel and Ordinary Setting of Propeller

and shallow-draught vessels. For rivers such as the Congo and Zambesi in Africa, the upper reaches of the Mississippi and its tributaries in this country, and for very shallow lakes, the idea of providing a tunnel for the propeller is admirable.

The illustration shows a propeller mounted in the ordinary way, and one working in a tunnel. Much less than half the depth of water is required for the latter as for the former.

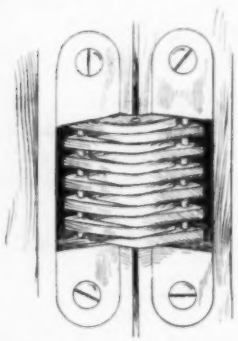
¶The London Daily Mail has offered a prize of $50,000 for a 1,000-mile aeroplane race, beginning and ending in London.



Type of Car Specially Used in California

INVISIBLE DOOR HINGE

This hinge is designed for use where it is desirable that no portion of the hinge should show when the door is closed. The making of the hinge is a somewhat difficult piece of die-casting, but were it to be made by machining in the regular manner, it would be costly. The hinge is cast in metal molds under pressure from a special, hard, white metal. The completed casting is ready for immediate assembling, and requires no fitting or finishing, except plating. The illustration clearly shows the operation of the hinge.



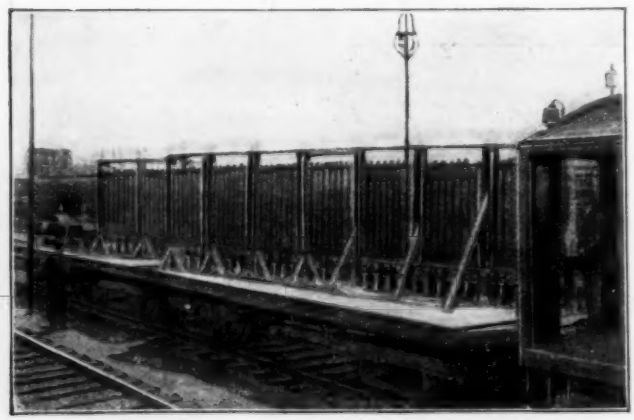
PHOSPHORUS POISONING OF MATCHMAKERS

That phosphorus necrosis of the jaw in a serious form is not at all a rare occurrence among matchmakers in this country is shown by the fact that the secretary of the American Association for Labor Legislation was able to unearth the records of more than 100 recent cases in a comparatively short time. These were found in 15 factories, employing 3,591 persons.

It is in the mixing, dipping, drying and packing rooms of the factories that the danger from breathing phosphorus fumes and from contact with phosphorus is present. Minute particles are believed to enter cavities in the teeth and set up the progressive inflammation and necrosis of the bones.

It is the white phosphorus that is poisonous, and it is the strike-anywhere match of this kind that is principally used in this country. The other kinds of matches are a safety match which contains no phosphorus and is harmless, and a strike-anywhere match in which poisonous phosphorus is substituted by the non-poisonous sesquisulphid of phosphorus.

This last type has been used exclusively in France for the last 12 years, due to legislation that prohibited the use of the white phosphorus. In 1905 a treaty providing for the prohibition of the making and selling of white phosphorus matches was secured by the International Association for Labor Legislation. This treaty has now been signed by France, Great Britain, Germany, Denmark, Italy, Switzerland, and the Netherlands.



Battery of Mercury Vapor Lamps on Flat-Cars

LIGHTING SUBWAY FOR MOVING-PICTURES

Interesting moving-pictures of the New York subway were taken some time ago by means of artificial light provided by the kind of electric light radiated by mercury vapor lamps. The pictures were taken from the cars shown in this illustration. The load the two flat-cars are carrying is a battery of mercury vapor lamps.

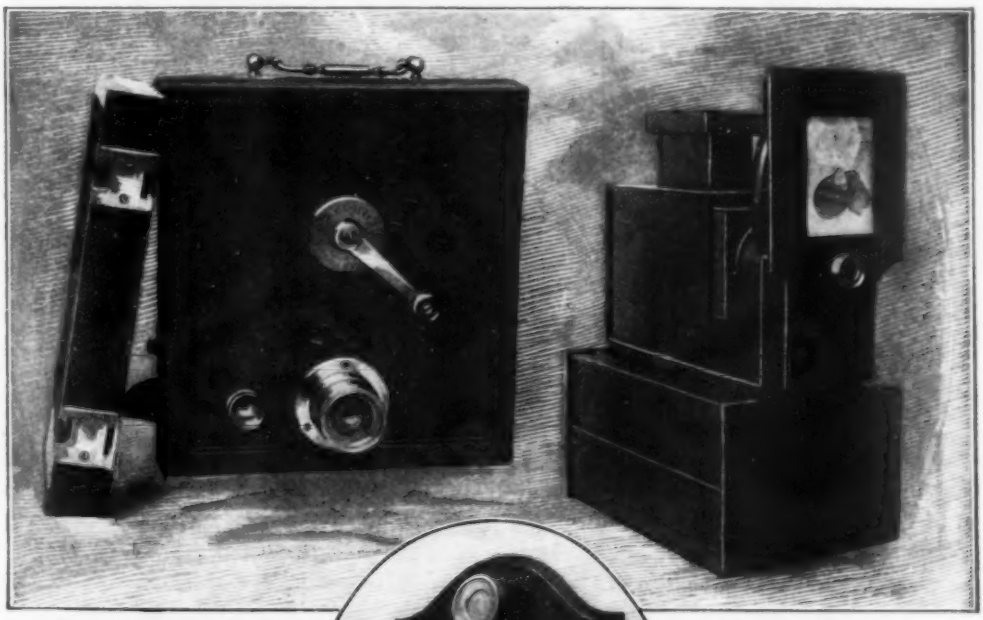
PORTRAITS THAT LIVE

By DR. ALFRED GRADENWITZ

WHILE the ordinary photographic processes have become exceedingly popular, the taking of cinematographic views has, so far, been reserved to the professional masters of the art. In fact, the enormous technical difficulties to be overcome in that direction, as well as the high expenditure, have deterred the amateur from any attempt towards producing animated scenes.

An ingenious apparatus, constructed by Lucien Rieffel of Paris, brings cinematography within the reach of the amateur. While not attempting to reproduce any of those complicated specimens of theatrical scenery which are the result of the development of the craft and the imagination of film-makers, it performs a most useful and interesting work. Whereas, in fact, the ordinary rigid portrait necessarily gives an inadequate idea of the person it is intended to represent, the views taken and inspected in Rieffel's device will produce a perfect illusion of reality by showing that essential element of life, motion.

The outfit consists of two parts: first, the photographic apparatus, allowing a set of successive photographs, 24 or 75, to be taken as easily as ordinary motionless pictures are made with the usual camera, and secondly, an apparatus for the direct inspection or projection of the positive disks, the succession of which produces the illusion of motion. From the negative disks containing



Camera for Taking "Living Portraits"

Apparatus to Project Portraits on Screen

Apparatus for Direct Inspection

these successive views the positive pictures are obtained in exactly the same manner as from any ordinary film or plate.

The camera for taking the cinematograph pictures comprises a circular glass plate, 15 centimetres (about 6 in.) in diameter, on which 24 or 75 successive pictures are recorded. The automatic working of this apparatus is obtained in a remarkably simple manner. In fact, the disk comprises a number of perforations, the distance between which corresponds to the distance between any two successive pictures to be distributed over the circumference of the plate. A special driving gear imparts to the plate a rotary motion, so that the portions destined to receive the picture will be stopped successively during a given interval of time, in front of the photographic objective.

In the apparatus designed for the taking of 24 pictures these are distributed over a circumference of the disk. The latter is accordingly placed in a photographic holder provided with a central knob, around which the circular plate or disk is free to rotate. By pressing down a button, a spring and accordingly a pivot, performing a lateral reciprocating motion, are released, the latter meshing as it were, with the perforations of the disk, and thus producing its rotation.

Disk with 75 Pictures Arranged in the Form of a Spiral

In the 75-picture apparatus, the ar-

rangement is somewhat more complicated. In order to keep the dimensions of the disk within convenient limits, the set of pictures had, in fact, to be arranged in a spiral, so that the disk, in lieu of a simple rotation, had to be imparted a helicoidal motion.

To this effect, the central knob is free to slide in a transversal guide, so that the pivot, in addition to turning the disk round, imparts to it a vertical motion, causing the pictures to arrange themselves spirally.

The objective of the apparatus is, like in an ordinary cinematographic camera, closed by a shutter during the time the moving disk is bringing in front of the objective the portion to be exposed. In fact, the very mechanism producing the motion of the disk also ensures the synchronous operation of the shutter. In order to prevent the sensitive surface of the plate from being exposed twice, which could not be avoided in the case of a continual motion, a special attachment stops the driving gear automatically as soon as the proper number of views has been taken.

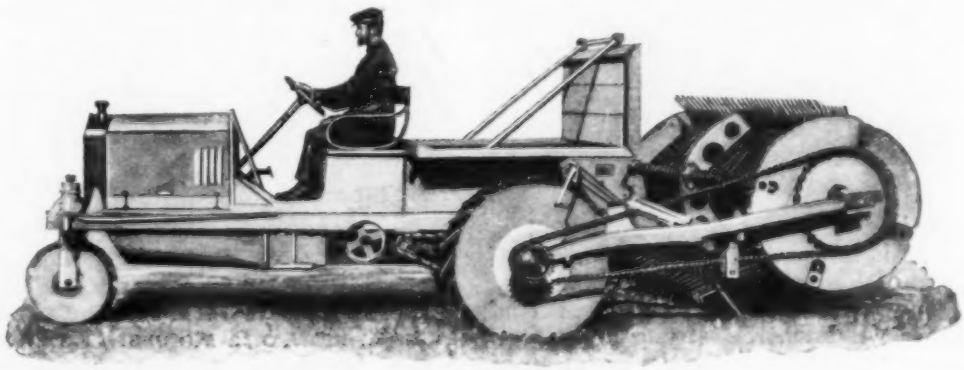
The other part of the outfit, the apparatus used for observing in succession the set of positive disks, is designed either for immediate visual inspection, or for projection on a screen. It comprises a disk on which the pictures are recorded in a circular or spiral arrangement, and a similar hand-operated driving gear which produces the same intermittent motion used in the taking of the views. The speed is considerably reduced, however, so as to produce a more lasting illusion. In case the apparatus is to be used for projection, it is combined with a magic lantern and screen, producing beautiful effects.

The devices thus enable anybody to keep a lasting record of anyone dear to him, not motionless, but in a familiar or typical gesture, and with the very appearance of life. Instead of fixing a single moment, as the ordinary camera, it thus allows a whole episode to be registered and reproduced.

SWISS AGRICULTURAL AUTOMOBILE-PULVERIZER

An agricultural automobile with a peculiar type of soil pulverizer, mounted in somewhat the same way as the stern paddle-wheel of a river steamboat, has been built by a firm in Switzerland for the preparation of light and dry soils which have been worked extensively. It is also used ahead of the plow when the soil is unusually hard.

The machine is of the 3-wheeled type, the single forward wheel being used for steering. The two rear wheels are very wide. The pulveriz-



Motor Soil Pulverizer

ing or cutting blades are carried on a drum, which is supported at the back of the machine body, and is raised or lowered by a pulley arrangement, actuated by a small handle at the side of the vehicle. The drum is driven by chain drive, passing over a trunnion at the end of the driving axle.

The cutting blades of the drum are a special feature. The drum is formed by three strong disks, connected by four shafts on which hinge the cutting tools, each shaft holding about 25 blades. Each of the four series of cutters falls back with the drum when lifted out of the soil, and falls out again when the drum has made a little more than half a revolution. The drum, actuated by power instead of by traction, does not retard the forward movement.

DEVICE MAKES PLANTS GROW STRAIGHT

A curious contrivance for enabling plants to maintain their straightness of growth in spite of the tendency of the sunlight to draw them out of alignment is in use at the Philadelphia College of Pharmacy. It can be adapted to any plant stand. If plants are placed in a window, the strong light will cause them to bend in the direction of the illumination. The little machine shown in the picture is a clockwork device that causes the plant to turn and so expose all sides to the light, preventing any distortion in the growth. The plant is made to move very slowly. In fact the movement is almost as imperceptible as that of the small hand of a clock, but it is sufficient to prevent the drawing power of the light from bending the plant from its straight growth.

Prevents Plant from Becoming Crooked

PRESS WHICH PRINTS AND DEVELOPS PHOTOGRAPHS

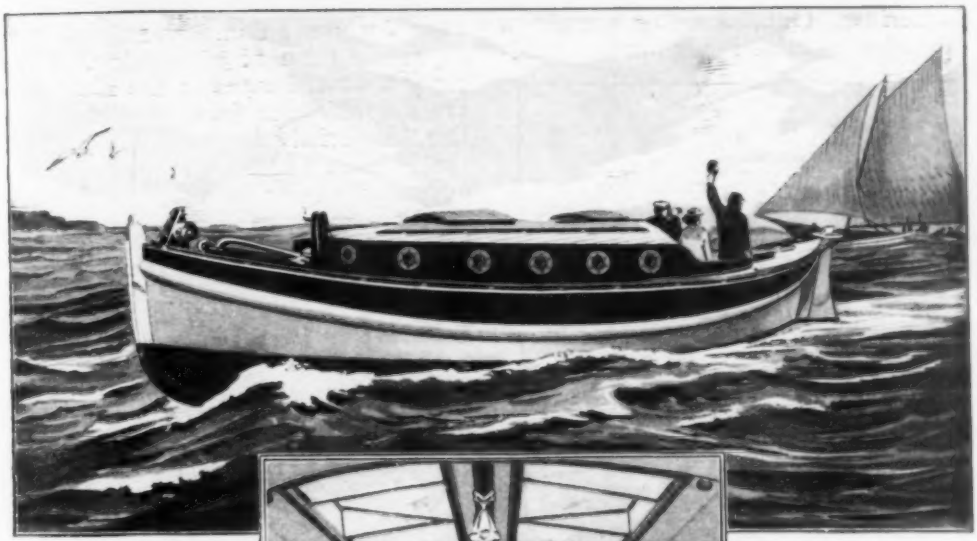
A press that prints and develops postcard photographs at a high rate of speed will, it is said, cut down the price of such cards to an almost unbelievable extent.

In operation, 500 cards are placed in the hopper or feedbox at one end of the machine, from which they are automatically fed into a printing-frame over any negative. After the correct exposure is determined by trial and the timer set for the number of seconds required, the motor is started and the work of printing, developing and fixing is carried on mechanically. The cards finally emerge at the completion of a cycle and drop into large rotary washing-tanks, from which they are taken at the end of an hour, drained and put into improved drying-ovens.

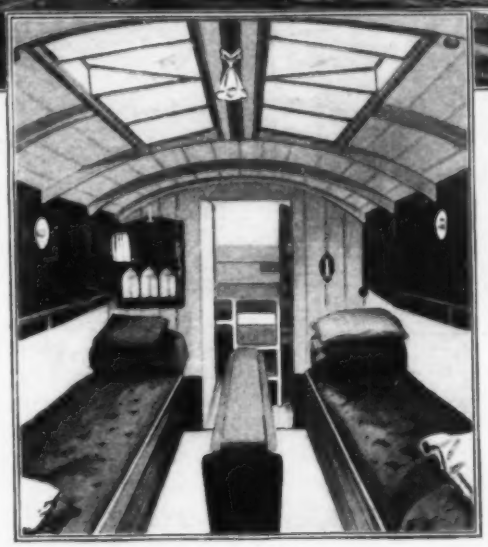
A thousand cards printed in this manner are said to be exactly uniform in tone, color and depth of printing.

¶The sun, shining through the plate-glass window of a store in Charlotte, Mich., ignited a stock of fireworks, causing a loss of $7,500.

LIFEBOAT CONVERTED INTO CRUISING MOTORBOAT



Exterior of Converted Lifeboat



Appearance of Main Cabin

That a lifeboat can be converted into a very seaworthy, comfortable, and handsome motorboat is obvious from the accompanying illustrations. The vessel shown is 34 ft. long, has a 7-ft. 6-in. beam, draws 3 ft. of water, and is constructed with a double shell of mahogany with a layer of felt between.

Under the turtle deck forward is a large locker for stores. Aft of this is a two-berth sleeping cabin, and still farther aft a saloon, also fitted with berths. The forward cabin is 6½ ft. long by 6½ ft. wide, and the saloon is 7½ ft. by 7½ ft. Back of the saloon, on the starboard side, is a lavatory, and on the port side a pantry. The 12-hp. engine which drives the boat is under the cockpit floor.

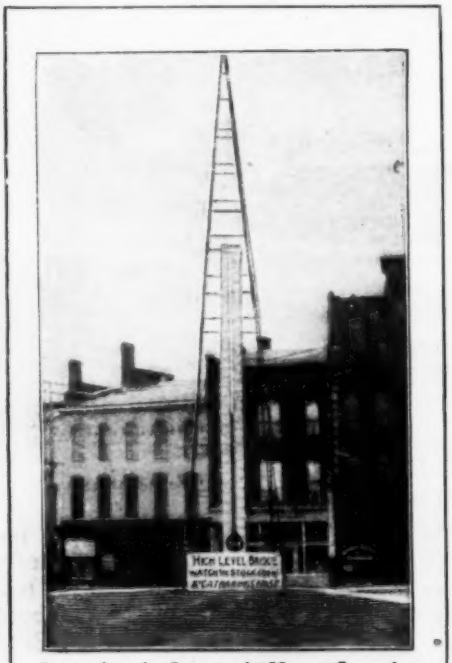
The boat belonged formerly to the Royal National Lifeboat Institution, England.

Such a motorboat would be stronger than the average motor craft and would behave itself in a heavy sea. The transformation could be made with comparatively small expense, if the boat were in good condition otherwise.

¶A remarkable operation was recently performed at the Post Graduate Hospital, New York, in which a Connecticut man whose jawbone had been eaten away by disease was provided with an artificial jaw of pure gold. One of the most difficult parts of the operation was in shaping the gold to match the original jawbone.

HUGE "THERMOMETER" REGISTERS CONTRIBUTIONS

Improvement organizations in St. Catherines, Ont., recently started a campaign to raise funds for the building of a high level bridge, and the unique "thermometer" shown in this illustration was adopted as a means of attracting interest to the progress made. It was erected on the strip of lawn in the center of the main street of the city, and at its base was the sign: "High Level Bridge—Watch the Stock Grow—St. Catherines First." The mercury was represented by a red ribbon, fastened to a cord running over a block at the top. As the campaign progressed the ribbon was raised to designate the amount received. The highest point the imitation mercury was to reach was the $50,000 mark, which is the amount the bridge will cost.



Increasing the Interest in Money Campaign

The ingenious apparatus was lighted at night by electricity and attracted considerable attention.

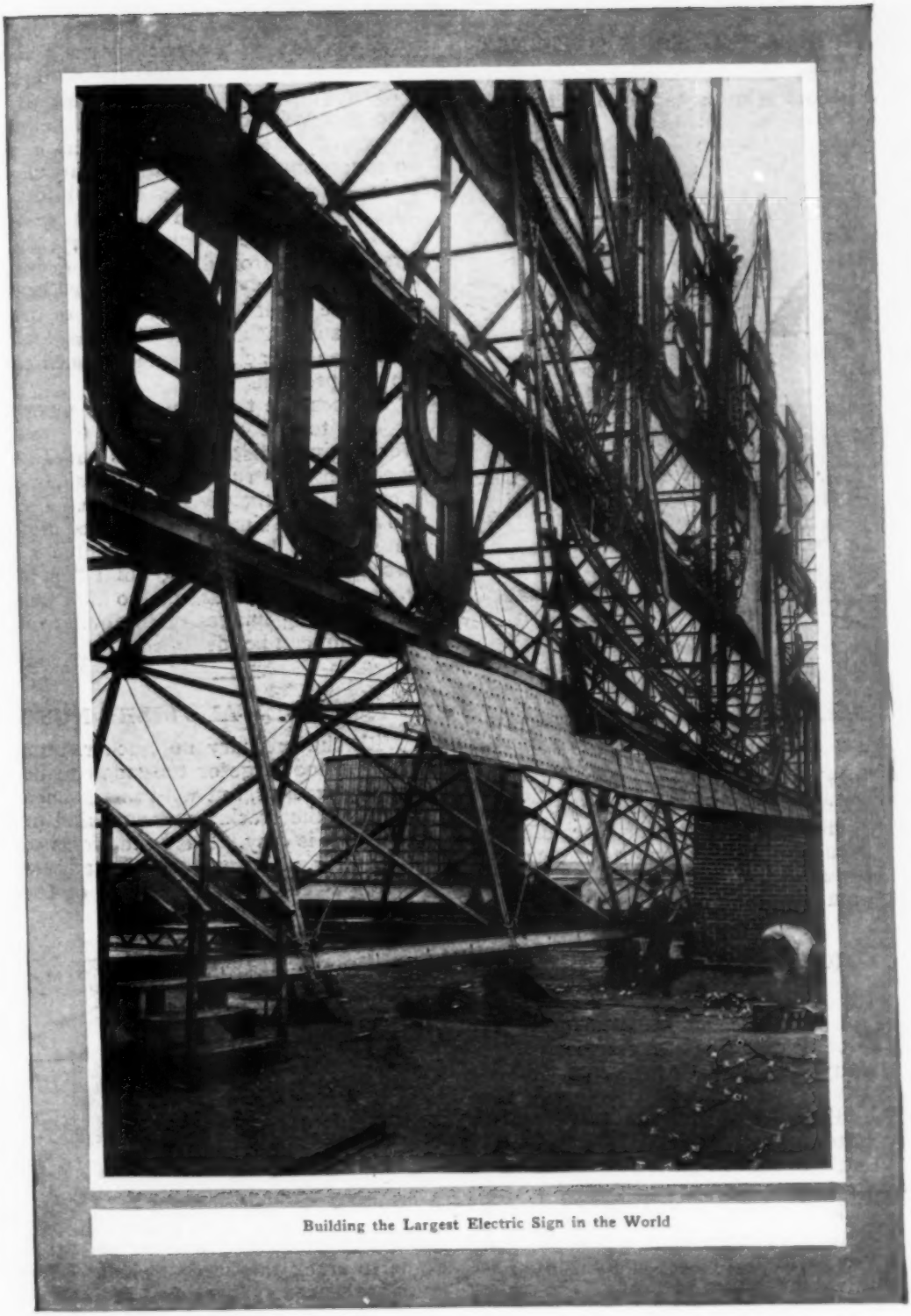
MAKING CHANGING ELECTRIC SIGNS

Electric signs with "moving effects" have become an important and very expensive form of advertising. They carry their messages in the night and are a spectacular feature of the "sky line," especially in New York, where the Hudson and East rivers, with the busy traffic upon them, afford fine opportunities for display.

The sign shown in the photograph herewith is one of the largest ever built and the cost ran well into five figures. It stands on the roof of a seven-story soap and perfumery factory in Jersey City within plain sight from the Manhattan side of the Hudson. The structural steel frame rises 50 ft. above the roof and is 200 ft. long. It is built with three stages for the workmen to walk on when making changes in the design, which is done at frequent intervals.

At one end is a huge clock face, with moving hands and a swinging pendulum below, which keeps accurate time. There are 1,000 four-candlepower incandescent electric lamps in the clock alone, and 4,000 others in the rest of the sign. A temporary feature of the sign, built especially for the Hudson-Fulton celebration last year, was a full-sized reproduction of Hendrick Hudson's ship, the "Half Moon," 80 ft. long.

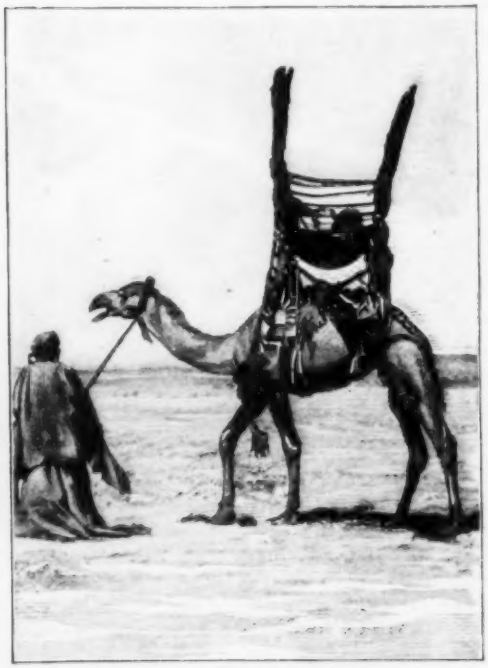
The outline of the ship was formed of trough-shaped strips of sheet metal having sockets into which the workmen screwed the electric bulbs, the wiring for the current being concealed behind the troughs. The sails and the water in which the ship floated were of flat sheet metal cut to shape and painted white and green respectively and plentifully studded with lights. The rope of the rigging was made of a simple pair of insulated wires carrying lights at frequent intervals. Moving effects simulating waves and the swinging of the pendulum of the clock were produced by means of motor-driven machines called "flashers."



Building the Largest Electric Sign in the World

A CAMEL HAMMOCK-SEAT

The curious trapping on this camel, seldom seen anywhere but far in the interior of the desert, is called a "walking hammock" by the English. It is a saddle in which two or three Bedouin women and children can ride at the same time, and is used in the marches from place to place.



Strange Camel Saddle

PHOTOGRAPHING THE SPEED OF BULLETS

A new method of measuring the velocity of a bullet by spark photography, which gives the actual velocity at two given points, as well as the time of flight between them, has been invented by Professor Crantz, author of a standard work on the vibrations of a gun barrel.

The apparatus consists of a horizontally pivoted revolving drum, covered with a photographic film, past which the bullet is fired. The bullet is illuminated as it passes the drum by a succession of electric sparks, discharged at a rate of 5,000 per second. The frequency of the spark and the rate of revolution of the drum being known, the velocity of the bullet can be determined by measuring the distance apart of the images of the bullet. The bullet is photographed at each spark. Were the bullet stationary, the film, when unrolled from the drum, would show a succession of images, one above the other, but the motion of the bullet causes each successive image to be displaced, each being in advance of the one preceding it.

"To measure the reduction in velocity due to the resistance of the air over a given distance," says the Engineer, "two instruments are set up, one at each end of the given distance. The two sparks are simultaneous, since they are supplied by the same source of current, and there is no difficulty in synchronizing the drums, so that the corresponding images of the bullet on each drum can be identified.

CRACKER FOR ALL SIZED NUTS

With the ordinary nutcracker, nuts are often too large or too small to be properly cracked, but with this French invention the cracking of any kind or size of nut is easy. It is in the form of a triangle, and is provided with a lever which, placed against the palm of the hand and pressed, provides sufficient force to crack the hardest shell. The nuts are placed as low down in the triangle as their size allows.

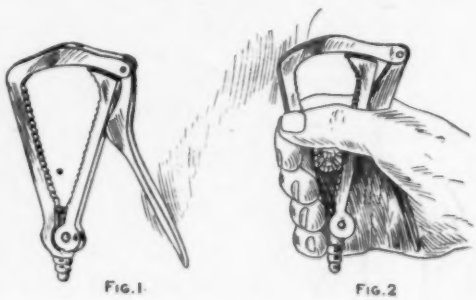


FIG. 1 FIG. 2

A Triangle Nutcracker

MACHINE WHICH MAY GIVE IMPETUS TO HEMP-RAISING INDUSTRY

The introduction of a hemp machine that extracts thousands of pounds a day and cleans it more thoroughly than manual labor can do, promises to greatly increase the acreage of hemp sown in the South. This is especially true of Kentucky, in which state the hemp-raising industry flourished before the war, when each plantation had its scores of slaves to handle the crops.

The hemp industry in that state is very old, the fiber having been cultivated in the early part of the last century. In 1859, 75,000 tons was produced. Twenty years later the entire United States produced only 5,000 tons. California and other Pacific coast states have taken up the industry and a fine grade of hemp is being produced in that section.

The New Hemp Machine and the Old "Slat Brake" Process, Used, Without Improvement, for Hundreds of Years

A steel hemp machine was operated in Kentucky for the first time in 1905, near the town of Paris. After a season's work it was sent to Cincinnati where a lighter machine was made. The second steel machine was made

and operated in the fields during the winter of 1906 and 1907. In 1908, an improved machine was built in Philadelphia and was used for shop demonstrations during that year. Then the machine was shipped to Kentucky and was used in the fields with great success.

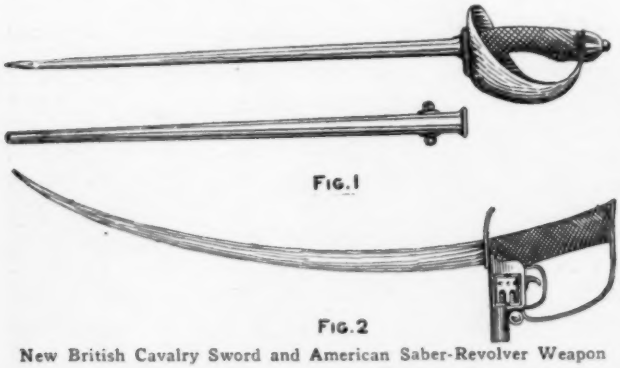


FIG. 1

FIG. 2

New British Cavalry Sword and American Saber-Revolver Weapon

The machine is made entirely of steel, makes scarcely more noise than a sewing machine, weighs about 5,000 lb. and is moved from field to field, similar to a wheat-threshing outfit. It requires seven men to operate at full capacity, and delivers 5,000 lb. of hemp or hemp fiber per day. By the old hand method one man does not average more than 150 lb. per day. The machine is run by a steam or gasoline engine and requires only 12 hp.

By comparative tests the machine has made 175 lb. more fiber to the acre than hand brakes under the same conditions. With the machine there is not a stalk wasted, as the farmer can go over his field with a hayrake and collect all the scattered and tangled stalks and run them through the machine, thus saving enough money to pay for the seed. The machine cleans and delivers the tangled stalks, and the product is known as tow, worth half the price of the line fiber.

¶Germany has an improved type of combination automobile and motorboat for use in time of war. The transformation from a land to water vehicle is made quickly, the motor being connected with a screw propeller in a few seconds.

NEW TYPES OF SWORDS AND SABERS

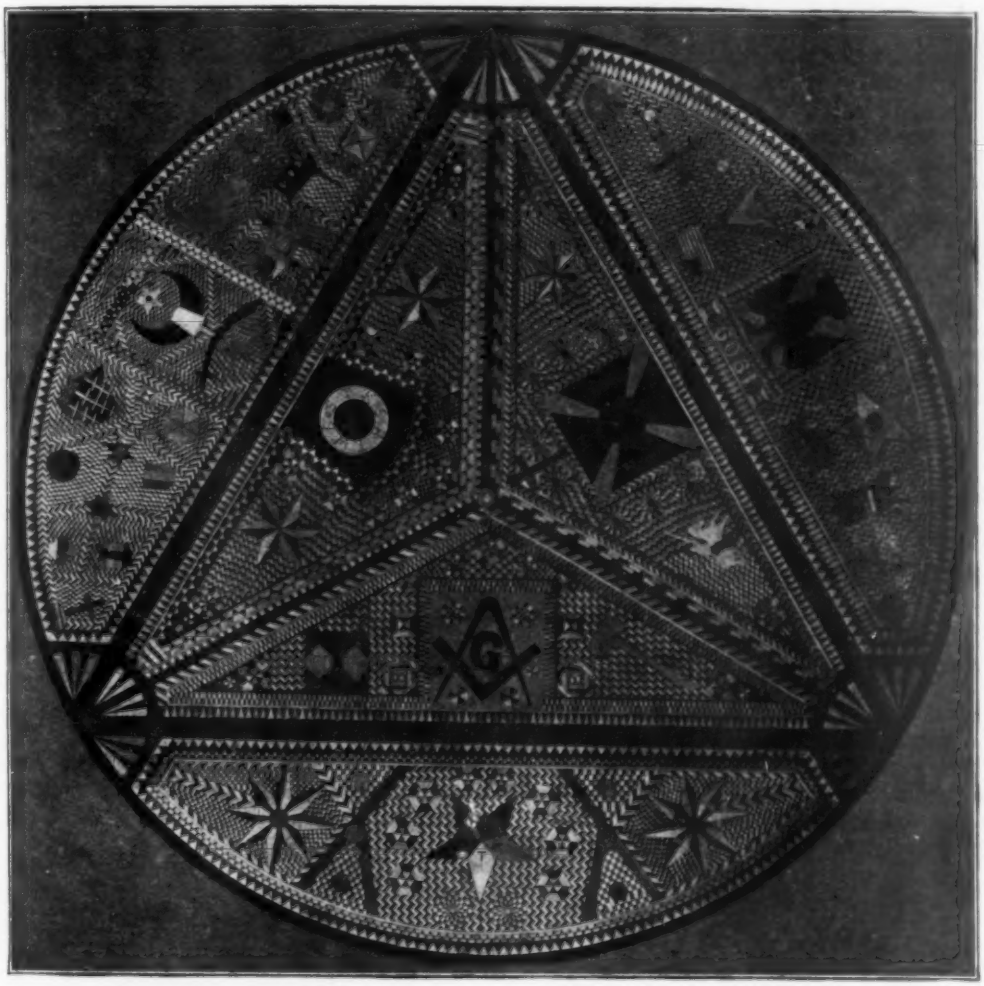
The large sword shown with its scabbard in Fig. 1, while it looks like a relic of medieval times, is really a very modern weapon, being the type just adopted by the British war office for use in the British cavalry. The extraordinarily large and heavy hilt, and the steel knob at the base of the hilt, are designed with a view to bringing the center of gravity of the sword as near as possible to the hand while grasping it. It is entirely a thrusting weapon, having a long, straight, rapier-like blade, sharpened only at the point. To give additional strength in thrusting, an ingeniously devised notch has been placed in the center of the forward part of the grip, on top, in which the thumb rests.

While a first glance would lead one to think the sword is too large and heavy for the ordinary soldier, those who have practiced with it claim it is exceptionally well balanced, and an excellent weapon for mounted troops. When this long, rapier-like blade is compared with the "cut-and-thrust" cavalry saber of the United States army, or the still shorter and heavier saber of the Russian cavalry (which are patterns of swords in use by nearly all other armies), it is at once seen what a radical change has been made by the British war office in selecting this side arm for the British cavalry, and army officers of all countries are awaiting with interest and no little curiosity the results of the adoption of this arm for cavalry use.

The scabbard is of heavy, polished steel, of perfectly plain pattern, tapering slightly its whole length, and is carried on a wide, leather shoulder belt, fastened into two rings firmly soldered to the edges of the scabbard.

The saber shown in Fig. 2 is an American invention. It consists of an ordinary saber with a short, hammerless revolver mounted at the hilt in

such a way that either the revolver or saber may be used without changing the grip.



Made of Wood Gathered from All Parts of the World and Places of Historical Interest

INLAID TABLE CONTAINS 34,473 PIECES OF WOOD

Phil J. Sargent of Cedar Rapids, Ia., formerly master mechanic in the Burlington railroad shops there, recently presented to the Iowa Masonic Library a table constructed by himself and containing 34,473 pieces of wood of historical interest, the design embracing numerous emblems of Masonic, as well as patriotic, interest. In the lower shelf of the table a figure is worked out with pieces of wood from every state and territory in the union. The work is beautifully done, there being not one imperfect joint in the wonderful top. In the center is inlaid a stone from King Solomon's quarries underneath the city of Jerusalem, and there is also a piece of wood from the Garden of Gethsemane. One piece was taken from the old elm under which Washington stood when taking command of the Continental army in 1777, at Cambridge. Another was taken from the farm on which Daniel Webster was born. Several presidents of the United States are recalled by the wood used

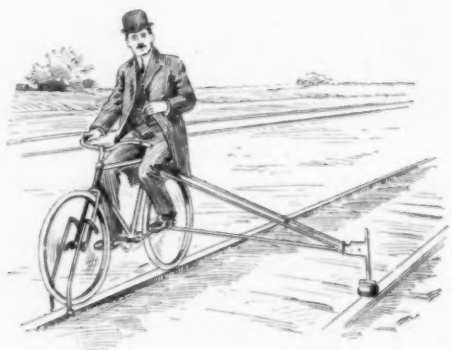
in the construction, and there are also relics of many wars. There is a piece, for instance, from an old liberty pole raised in 1856 in Bow, New Hampshire, that state being Mr. Sargent's old home, and another from the old belfry in Lexington in which the bell was rung to call out the minute men at the commencement of the Revolutionary War. Still other pieces are from the Lexington and Concord battlegrounds. There is a fragment of the original floor of Libby prison, and a piece from the old line battleship "Constitution." To tell all the historical incidents and places commemorated would require several pages.

Many educational institutions are represented, and there is, also, a piece of the old chestnut tree made famous by Longfellow's "Village Blacksmith." The log cabin in Tennessee where Davy Crockett was born, the oak under which Elliott preached to the Indians at Wellesley, Mass., and the San Juan mission in California are brought close together in this interesting table. There is wood also from Panama, Japan, Mexico, Siam, Joppa, Cuba, Argentine, Alaska, Samoa, Manila, Scotland, England, Canada, Germany, Italy and France. Every clime has contributed the choicest of its woods. Central America has sent its mahogany, Africa its ebony, and Japan its camphor wood. The south has sent its tulip tree and the north the sturdiest of its oaks and elms. North Carolina sends the beauty of its rhododendron, the famous Hood River valley the perfume of its apple blossoms and its grape clusters. The pepper tree and the eucalyptus of sun-browned California are there, and the subtle essence of the olive tree, from Palestine. The pure white wood of the English holly is contrasted with the dark beauty of the black walnut, and the rosy hue of the rosewoods is made to harmonize with the precious woods of the Orient.

BICYCLE FITTED TO RUN ON RAILROAD TRACK

A set of attachments, by which the ordinary bicycle can be made to run on a railroad track, has been brought out in France and is said to be meeting with perfect success.

How Attachments Are Carried When Not in Use



Bicycle in Position on Rail

Two distinct attachments are used, one to insure the straight running of the bicycle and the other to maintain the equilibrium. The first mentioned consists of a set of forks attached to the regular forks of the bicycle. The lower ends of these forks bear ball rollers and these, coming in contact with each side of the rail, resist derailment without resulting in enough friction to impede the speed of the rider.

The second attachment is a light

Elliott Woods, Superintendent of the United States Capitol Building and Grounds, Making an Examination of the Air in the Halls of Congress

bicycle-tube framework, bearing a roller at its outer end. This frame is made fast to the bicycle under the saddle and at the hub of the rear wheel, and extends to the second track of the railway. The roller it carries runs on the top of this rail and maintains the equilibrium of the machine.

The possibility of one track being higher than the other, as at curves in the road, is provided for by means of the light bar that runs along the top of the framework supporting the outriding roller. This, operated by a handle within reach of the rider, engages with a mechanism which allows the roller to be vertically extended or drawn closer to the end of the framework, thus making possible the proper pitch of the machine, so that it will always be slightly leaning towards the second rail.

When the bicycle is in ordinary use, the outriding roller and its framework are attached to the upper bar of the frame and the set of forks is raised clear of the ground.

INSURING CLEAN AIR FOR THE HALLS OF CONGRESS

Because of the extremely poor ventilation in the Senate chamber and the House of Representatives, constant vigilance must be exercised to make sure that the men engaged in formulating our laws shall not be surrounded with air full of bacteria and impurities. The two halls of Congress are really inclosed boxes. A system of ventilation was provided, of course, but the opening of a few doors here and there generally put the entire system out of order. The worst conditions are said to exist in the House, near the Speaker's chair, and the best air is found in Senate, around the Vice President's desk.

The responsibility of maintaining the air in the chambers rests upon Elliott Woods, superintendent of the Capitol building and grounds. At frequent intervals during every session of Congress examinations of the air are made by Superintendent Woods, assisted by members of the marine-hospital service.

Gelatine plates are exposed to the air outside the building and other plates are exposed to the air inside the chambers for the same period of time.

The difference in the number of bacteria and the amount of impurities found in each, furnish a test of the conditions inside.

DIGGING A FOUR-MILLION DOLLAR TUNNEL WITH BARE HANDS

One hundred and twenty-five feet beneath the sunlight, in the bowels of one of Seattle's many hills, workmen have been trying for a year and a half to drive a sewer tunnel. In that time, about 550 working days of 24 hours' duration, these human moles have advanced their burrow 900 ft. They still have 3,000 ft. to build.

Ravenna hill is a natural sponge. Its huge bulk is mined with submarine lakes and pockets of water and it was only after air pressure had been pumped in that the men in the bore could work with any degree of safety or success.

The job is a small section of Seattle's great North Trunk Sewer, a system extending from Lake Washington, the body of fresh water bounding the city on the east, to Puget Sound, salt water, on the west. The big trunk sewer, which will cost $4,000,000, involves much tunneling, some of it dangerous, but none of it can compare in danger, discouragement and vexation with the little Ravenna hill bore.

Imagine trying to bore a tunnel through a bowl of soup and you can picture the troubles of the contractor who is driving the hole through Ravenna hill. Down in the 6-ft. bore, drenched by a blinding downpour of water which leaks through the lagging overhead, the tunnel crew works shoulder to shoulder with death in half a dozen forms. Sometimes it is a heavy timber at the head of the bore which cracks and breaks with a reverberating report. Sometimes it is a post being driven into the floor or a lagging driven into the breast of the tunnel that pierces a pocket of water and drives the men, like rats, to seek shelter in the air gate. Sometimes before timbers can be placed the ooze pours out on them in a strangling, sticky mass.

An idea of the nature of the task can be gained from the fact that the average day's "drive" is 7 ft. and at times the workers have toiled 24 hours and added a foot and a half to the distance covered.

A hundred and twenty-five feet above the bore a woman had a house built and a cement floor put in her cellar. So porous is the hill that the imprisoned air in the bore below rushed up and split the newly laid floor with a million tiny cracks.

The tunnel is dug largely by bare hands. The breast is planked up stoutly, with merely a large enough hole in the planking for a man to reach in his arm and scoop out the muck. When a hole is started, lagging is driven in overhead. Then a plank is removed and the hole enlarged. Later one and then two workmen crawl in and enlarge the cavity until the plank shield can be advanced a few feet.

The rest of the North Trunk Sewer job is making excellent progress through hard clay and sand. Apparently nature has picked the Ravenna hill portion as the battleground for her hand to hand struggle with the human moles.

INDIAN MILL IN NEW MEXICO

This square log structure is an Indian mill on a reservation near Santa Fe, New Mexico. It is run by water power, the wheel being 24 in. in diameter, mounted on an upright shaft in direct connection with the burr that does the grinding. The capacity of the outfit is about one-half bushel per hour.

SHOP NOTES

Emergency Repair Outfit for Motorboats

The following outfit of repairs should be carried on every motorboat and yacht. A leak that would sink a boat in a few minutes can be quickly repaired if the necessary tools and materials are at hand. The outfit should contain the following articles:

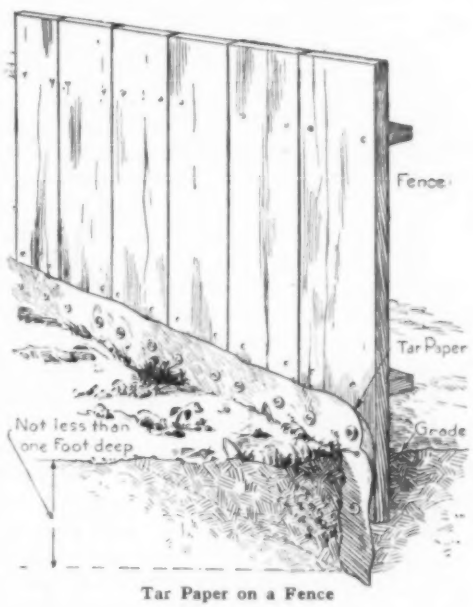
2 yd. heavy canvas.
5 lb. oakum.
5 lb. mutton tallow.
2 lb. shingle nails.
1 package of large carpet tacks.
1 piece of pine, ½ by 12 by 18 in.
1 piece of pine, ¼ by 12 by 18 in.
1 sharp hatchet.

Carry the lumber, oakum and canvas in the shape of a cushion with the two boards as a base and the oakum on top. The canvas wrapped around the whole will form a cover. It should be slightly fastened with a string so it can be easily opened in case of accident.

Place the hatchet, tallow, tacks, nails and canvas cushion where they may be easily found. Should the boat spring a leak or be snagged below the water line, cut away the ceiling, flooring or whatever is necessary to reach the hole from the inside, then place a "soft patch" over the opening. Cut a piece of the ½-in. board the right size to cover it. On one side of the board tack two thicknesses of canvas, and, if the canvas and board will not fit flat against the planking and make a tight-fitting cover, place oakum between the canvas and the board, and nail the patch over the hole. If the hole can be reached from the outside, insert oakum and daub it over thoroughly with tallow. If the hole is small it can be stopped with oakum and tallow until the soft patch can be prepared. If the hole is large use a pillow or piece of blanket. Should the hole be above or just at the water line, tack a good sized patch of canvas on the outside of the hull, using battens made of the ¼-in. board, fastening them with the shingle nails.—Contributed by John P. Cowing, Chicago.

Tar Paper Keeps Out Vermin

A cheap way to keep rats, mice and ants from gnawing their way through a wall or fence is to tack some tar



Tar Paper on a Fence

paper on the place where they are liable to enter. If it is a solid board fence put the paper on the bottom and let it extend into the ground, as shown in the illustration. This class of vermin will not gnaw through anything saturated with tar. The tar paper can be used to keep out most vermin in addition to the advantages of waterproofing and preserving the wood.—Contributed by A. P. Connor, Washington, District of Columbia.

Combination Hinged and Roller Doors for a Garage

The owner of a private garage wished to have the doors so arranged

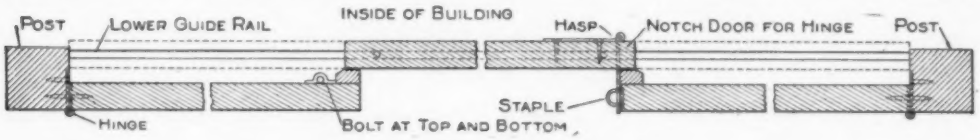


Fig. 1—Three Doors on a Garage

that he could open two-thirds of the front at once and on either side. This required three doors, and as there was no chance to slide all of them, two were hinged and one made to slide, as shown in Fig. 1. The middle and inside door was hung on an overhead track and could slide to either side of the opening. The two outside doors were fastened with hinges to the posts as shown. An inverted trolley track was placed in the cement floor under the middle door as shown in Fig. 2. Two lag screws were screwed into the bottom of the door and their heads cut off, leaving the stem projecting about 1 in. The door was then hung with these pins in the slot of the trolley track, and the result was a door that would slide freely in either direction, yet was held firmly from swinging in or out. One hinged door was provided with top and bottom bolts on the inside as shown. The middle door had a hinged hasp attached that would fit over a staple in the other door. By means of this arrangement the doors could be locked with a padlock from the outside. When one side was to be opened the sliding door was pushed over a hinged door and the opposite one swung open.—Contributed by E. E. Harriman, Los Angeles, Cal.

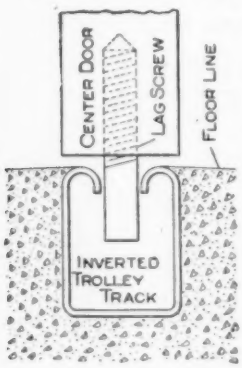
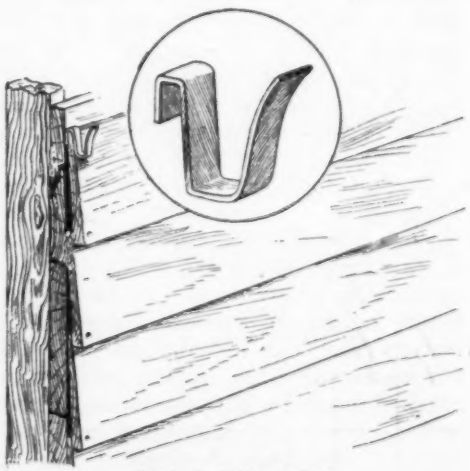


Fig. 2

Hooks for Holding Siding While Nailing

When placing on long lengths of siding or weather-board a carpenter finds it necessary to supply some sort of support for the one end while he marks the other for sawing to length. The most common method of obtaining this support is to temporarily drive a nail into the last board put on and allow it to project far enough for the next board to rest upon. As fast as a board is nailed in place the nails which acted as its temporary support must be withdrawn and moved up the width of one board. This procedure not only takes considerable time, but unless extreme care is used, one is liable to crack quite a few boards, since the temporary nail must be driven at a point where the board is not very solidly backed.

A convenient substitute for the above method is to use two hooks as shown in the accompanying sketch. These may be made from the metal strips found on every bunch of shingles, but are preferably made from spring steel,



Method of Using Hook

if one expects to have very much use for them. The dimensions of the hooks are made to suit the lap desired. It will be found that it is much easier to move the hooks up as the work proceeds than it is to drive and pull the nails as is customary.—Contributed by M. R. Wells, Racine, Wis.

One-Man Bag Filler

It very often happens that one wishes to fill sacks with small grain, apples, potatoes, etc., but has no one to help hold the bag. An excellent method of doing this is to procure an old wooden or metal bucket and knock out the bottom. If it is a metal bucket, file the

Bucket Without a Bottom

edges smooth to prevent its tearing the bag. Set the bucket in the mouth of the bag as shown in the illustration and you will have no trouble in filling it. —Contributed by D. J. Tancik, Lyons, Iowa.

Extracting Small Slivers

Frequently a workman is unfortunate enough to get small slivers of wood or steel or iron into the flesh and have them break off level with the surface of the skin. These little slivers are often too small to be seen with the naked eye and are therefore very difficult to remove. They are very painful and a cause of much annoyance, but if the workman has a small folding pocket magnifying glass as shown in the accompanying sketch his troubles are

Microscope Used with Eye Glasses

soon over. This little magnifier can be used with glasses as well as without and can be folded up and kept in a small leather case to prevent its being broken. Every machinist should own one as it would be the means of preventing a great deal of discomfort.

Refrigerator Made of a Barrel

An inexpensive refrigerator can be made by using a water-tight barrel, on the inside of which is placed a metal box, supported on a stand set on the bottom of the barrel. A hinged door is supplied to cover the opening. The metal box can be made of heavy tin or galvanized sheet iron, well soldered along the seams. The barrel is then filled about the metal box with coarse gravel, leaving room at the top for the ice. The metal box with the support and board for holding the ice is shown

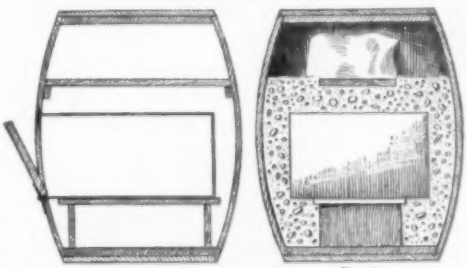


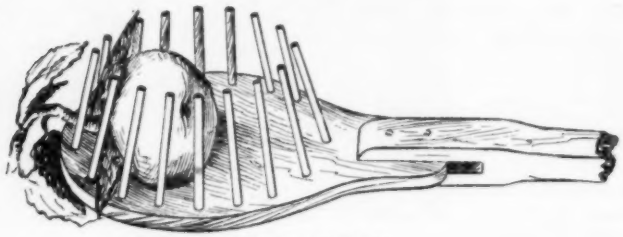
Fig. 1 Fig. 2

Barrel Refrigerator

in Fig. 1, and the completed ice box in Fig. 2. A hole must be bored in the bottom of the barrel to drain out the water.—Contributed by C. C. Brabant, Alpena, Mich.

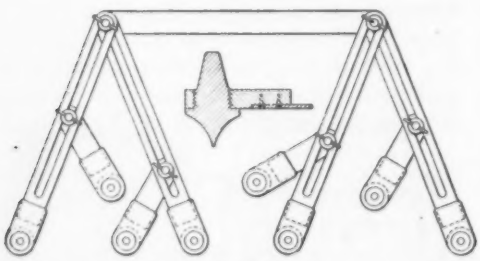
Tool for Transferring Holes

Machinists and repairmen often have occasion to transfer a set of holes from one piece of metal to another, a difficult



Fruit in the Picker

task unless one has the proper templets. The little tool shown in the accompanying sketch was devised for this work and has proven very satisfactory. Simply loosen the thumb-nuts and let the different points and arms conform themselves to whatever position the holes may be in, tighten the nuts, set the instrument on the work with the sharp points down, and tap each one a slight blow with the hammer. If the end points are marked first they will tend to hold the tool in place while the others are being marked. It is a universal tool as it can be used for any number of holes up to eight at one time. The small sketch in the center



Details of the Templet

shows the detail construction of the punches and end plates. The points of the punches should be hardened.—Contributed by C. G. Smith, Brooklyn, New York.

¶Reverse the flow of electric current periodically to reduce the wear on vibrator points.

A Fruit Picker

Scattered fruit on a tree is hard to pick by climbing a ladder. If the fruit is shaken off, the fall will cause bruises that make it unfit for storage or shipping. I devised the picker shown in the accompanying sketch to remove the fruit growing on the ends of branches and in places not easily accessible.

The device consists of a long handle to which is attached a board having pegs 9 in. long fastened in a circle, and set so that their ends incline toward the center. The stem will slip through between the pegs and the fruit can be easily pulled off and retained by the pegs.—Contributed by E. H. Nahm, Cleveland, O.

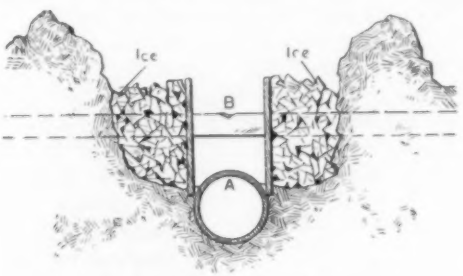
Drilling Holes Half in Cast Iron and Half in Steel

Anyone who has tried to drill holes half in cast iron and half in steel knows how difficult it is to keep the hole exactly divided between the two metals. A case of this kind is where a cast-iron wheel is held on the end of a shaft with a round key. Cast iron being much less dense than steel, and containing numerous small holes, induces a drill, no matter how well started, to follow the law of least resistance, and if the hole is deep enough it will surely end up entirely in the cast iron. A good way to overcome this is to chip, file or plane in the steel piece a slot as long as the length of the hole to be drilled. In size make it about one-third the area of the final half hole in the steel. Then assemble the two pieces and start the hole half and half, and you will end up with a very nearly straight hole. This slot, which reduces the amount of steel to be removed by the drill, offsets, or rather balances the lighter structure of the cast iron and has this effect for the whole depth of the hole.—Contributed by D. Hampson, Middletown, N. Y.

Freezing Water in a Main to Make Repairs

In removing an old water main the workman doing the digging accidentally hit a lead pipe which branched from the new main, making a hole from which the water flowed quite freely. As it was impossible to shut the water off, a difficult problem presented itself as to how the leak could be stopped and the pipe repaired.

In the accompanying sketch A shows the main that was being removed and B shows the break in the lead pipe where the workman pierced it with a pick. Ice and salt were packed around the pipe which slowly froze the water within and stopped the flow. This enabled the men to solder up the hole,

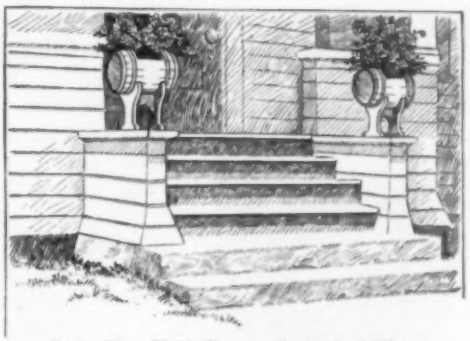


Freezing the Water Main

after which the ice was removed and the frozen water allowed to thaw.—Contributed by Frank L. Walter, Dayton, Ohio.

Turning Polished Nuts

Almost all machines are made with some nuts or bolt heads finished "bright" or highly polished, and to set them up tight and not mar the surfaces calls for more than an ordinary monkey wrench. A special socket head must be made to fit the head close and used with an ordinary wrench in turning a nut. Where only a few bolts or nuts are to be tightened, take a strip of heavy tin or zinc and bend it to the shape of the nut to take the place of the special socket head. The jaws of the wrench should be perfectly parallel and set up as close as possible.



Casks Now Hold Flowers Instead of Water

Jardinieres Made of Water Casks

This pair of attractive porch ornaments can be easily duplicated by any handy man who can find a couple of small kegs and some bits of boards.

The ones shown in the illustration are little oaken water casks with oval heads which set on a little rack, such as are used on shipboard. The bunghole was enlarged with a key-hole saw to a diameter of 5 in., then the improvised flower pots were filled with earth and plants set in. A couple of coats of paint add to their appearance.

Hand Vise

A neat and serviceable little hand vise that will be found very useful in the workshop is shown in the accompanying illustration. The jaws are loose on the pins and have a spring at the back which allows them to open parallel. The jaws are also held open at all times by means of this spring. They will hold a tapered piece of work as well as a straight piece and readily adapt themselves to fit any odd shape. They are adjusted by turning the handle, which moves the threaded rod,

Machinists Hand Vise

fastened to the crosspiece, in or out, as the case may be, thereby opening or closing the jaws.—Contributed by Robert Stewart, Hartford, Conn.

A Rain Gauge

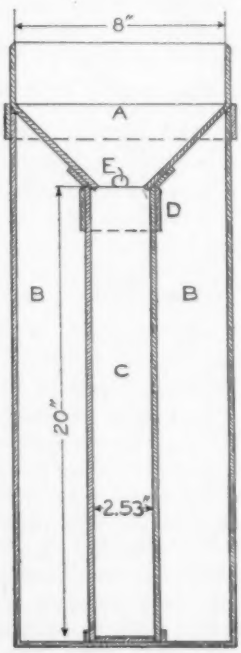
By SAMUEL K. PEARSON, JR.

Rainfall is measured on the basis of the depth of water which would accumulate on a perfectly level surface provided all of it remained as deposited without loss by absorption, "run off" or evaporation. The instruments used to determine the depths of the fall, most commonly known as rain gauges, are neither well known by sight nor is the method by which they record the rainfall perfectly understood by the general public. With such a gauge an amount as small as 1/100 in. may be measured without difficulty.

Rain gauges are composed of three parts: the receiver, A, the overflow attachment, B, and the measuring tube, C. Those used by the United States Weather Bureau are of the type shown in the accompanying illustration. The top portion of the receiver A is 8 in. in diameter inside, which has a funnel-shaped bottom to carry the rainfall caught into the long narrow cylindrical measuring tube C. The height of the measuring tube inside is 20 in., with a diameter of 2.53 in. As the area of the receiver is greater than the area of the measuring tube, a small portion of rainfall will show quite a depth which is easily measured. The amount shown in the measuring tube is 10 to 1. For example: an actual rainfall of 1 in. taken in the large receiver would measure 10 in. in the measuring tube, while an actual fall of 1/100 in. would produce 1/10 in. in the tube. The depth of water in the measuring tube is obtained by inserting a narrow stick or ruler graduated in inches and tenths of inches.

The measuring tube will hold 20 in. of water or 2 in. actual rainfall. Such an amount is considered a heavy fall, but for the measurement of excessive falls of rain the sleeve D of the funnel receiver fitting closely over the top of the measuring tube is provided with a little opening, E, on the same level with the top of the tube, so that the excess water will escape through this opening into the large overflow attachment, B. The surplus water caught in B can be poured into the measuring tube and the amount added to the 2 in. which filled the tube to the brim.

During the winter months both the receiver and the measuring tube are removed from the gauge so that precipitation falling in the form of snow or sleet may be caught in the receptacle. The snow is then reduced to water and poured into the measuring tube and its depth obtained by the same method as rainfall. A record of the depth of snowfall unmelted is also observed and recorded, and it is usually found that its equivalent in water is 10 to 1, that is 10 in. of moderately moist snow will produce, when melted, 1 in. of water. Frequently it will yield a much lessser or greater amount of water, according to the quality of the snow, whether of a



light and dry, or heavy and moist character.

The regular stations of the weather bureau use an electrical recording gauge, equipped with a small tipping bucket below the funnel, which tips when filled with each 1/100 in. of rainfall, and records each tip upon a chart. Thus the amount of rainfall is measured by the number of tips which can be recorded at any distance from the gauge.

Speed of a Shaft Found Without an Indicator

Having occasion to take the speed of a line shaft, and finding that I had left my speed indicator at the office, I used the following method which may be of service to others in the same predicament.

Simply strike the end of a shaft with a hammer, as shown in Fig. 1, hard enough to make a small dent or depression on the edge. Hold your finger on the edge, guiding it with the thumb as shown in Fig. 2. The depression, A, is easily felt as it travels under the

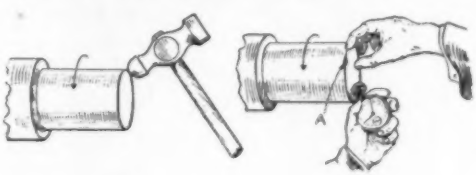


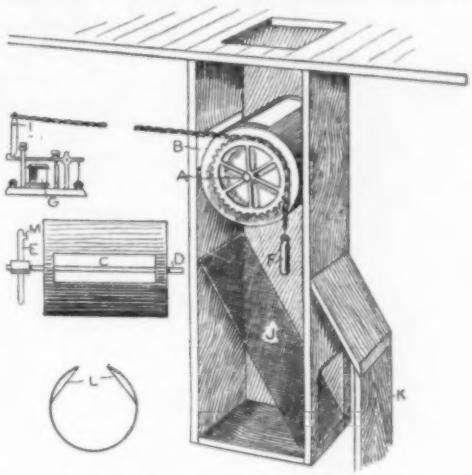
FIG. 1 FIG. 2

Finding the Speed of a Shaft

finger, and in this way the speed of shafts running as high as 300 to 400 r. p. m., may be more accurately taken than with any indicator except the most expensive ones with automatic stops.—Contributed by E. W. Davis, Chicago.

Automatic Horse Feeder

A simple and easily constructed device for feeding a horse his grain at noon when no one is about is shown in the accompanying detail sketches. The chute opens through the floor into the grain bin above, and is drawn with the end board removed in order to better show the arrangement of the drum. A drum having a diameter the same size as the width of the chute, is fitted into it and revolves on the axle D,



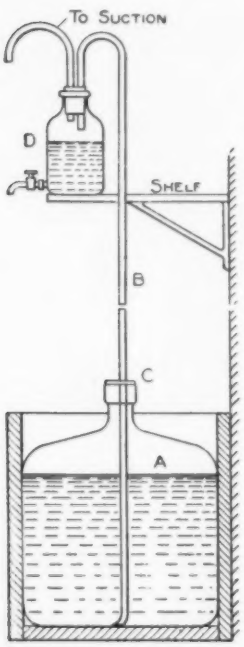
Feeder Operated by Electricity

to which it is securely fastened. It is provided with a slot, C, for the grain to pass in and out. The axle projects at one end and to this is fastened an ordinary bicycle sprocket wheel as shown. A lug, M, fastened on a spoke of the sprocket wheel, allows the drum to turn only half way around. This is an important feature of the device. A bicycle chain with a weight, F, at one end, is hung over the wheel as shown and the other end is fastened over the end of the small lever. This lever works on a pivot, I, and is released by means of the telegraph sounders, thus letting the chain slip off. When released the weight turns the drum and empties the grain. The telegraph sounder gets its electrical connection from an alarm clock in the home. As the grain is dumped from the drum it falls on the screen, J, thence into the chute, K, and drops into the feed box below. A couple of flash tins, arranged in the drum as shown at L, will help to empty the drum completely.—Contributed by C. G. Smith, Brooklyn, N. Y.

¶Always put a washer on a lag-screw before turning it into the wood.

A Convenient Method for Handling Acids

The device shown in the accompanying sketch is simple and inexpensive, and its advantages are many. Nothing but glass comes into contact with the acid, no fumes escape into the air. The carboy is not subjected to pressure, nor is it necessary to move it, thus obviating all danger of splashing, etc., says a correspondent of the Chemical Engineer.



The figure is self-explanatory. A is the carboy, B a glass tube ¼ in. in diameter, bent at the lower end so that the bottom of the acid may be reached, C is a loose cover of sheet packing, to keep dust out of the carboy; D is a 2-liter bottle, closed with a 2-hole stopper. The tube B passes through one hole, and a short bent tube through the other, to which is connected, by means of a rubber tube, a suction or filter pump.

On starting the pump a partial vacuum is created in the bottle and the acid flows into it. To stop the flow it is only necessary to disconnect from the pump. By using an aspirator bottle with a glass stopcock at the bottom, the apparatus may be made permanent and need not be disturbed until the carboy is empty.

¶Automobile oil lamps should be emptied and boiled in water once a month. This will remove all dirt and prevent them going out when in use.

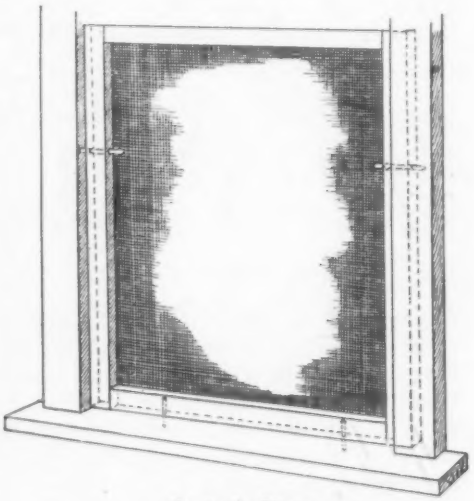
Repairing Leak in Water Leg of Fire Box Boiler

Fill the water leg with a mixture of two parts cement and one part sand so as to cover the leak, and allow to stand over night. When repaired in this manner the boiler can be used for months, if necessary, or until permanent repairs can be made.

Government boiler inspectors have allowed such repairs, made on marine boilers, until the boat could be laid up for repairs or went into winter quarters, where the leak was so bad that it could not be patched, except by putting in new sheets.—Contributed by J. P. Cowing, Chicago.

Fastening a Screen Frame in a Window

A simple way to fasten screen frames in windows is to cut off the heads of two wire nails and use them for pins in the bottom piece of the frame. Bore small holes in the sill to receive the pins. Use two old-fashioned spring



Screen in Place

window stops for the sides. The screen can be put in and taken out quickly.—Contributed by F. D. Heiser, Biddeford, Maine.

¶Never change a single ball in a bearing. Renew them all.

Home-Made Door Knobs

A substitute door knob can be quickly made in the following manner: Take the unbroken knob, imbed it in some soft clay, and make a hole around the bolt so the metal can be easily removed. After the clay is well pressed together, as shown in Fig. 1, it is cut in two with a thin sharp blade of a knife. The knob is then removed, leaving a perfect clay mold in halves, as shown in Fig. 2. Fill the lower half of the mold with a neat mixture of cement. Place the bolt taken from the broken knob in the hole made in the other half of the mold and fill it with cement well packed around the metal bolt. Then place both halves of the mold together and set aside until the cement hardens. It is best to remove the knob from the mold before it is too hard and paint the surface over with a very soft mixture of cement to fill all

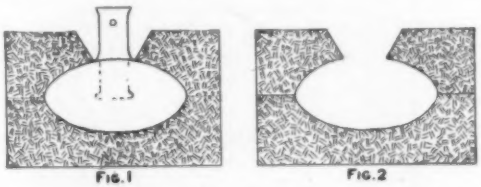


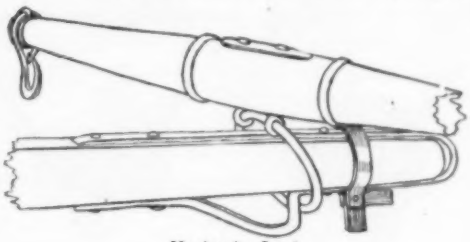
FIG. 1 FIG. 2

Clay Molds

holes. The knob can be smoothed up with fine sandpaper before the cement has set hard. If a coat of enamel is applied the cement knob cannot be detected from the original porcelain knob.—Contributed by C. C. Brabant, Alpena, Mich.

Holding the Neckyoke on a Tongue

The little device illustrated herewith, when applied to the end of a vehicle tongue, prevents the neckyoke from slipping off and may thus avert a disastrous runaway. It is made by bending a piece of ½-in. rod, about 4 in. long, at right angles and drilling a hole through it in the bend. This is attached to the under side of the tongue by an iron strap, fastened around the wood so that the rear angle hangs down and the forward angle lies parallel with the tongue. When the ring of the neckyoke is passing over the end of the tongue the lock is tilted forward



Neckyoke Lock

and then drops back in position as shown, after the ring is in place.—Contributed by Thos. L. Parker, Olaf, Iowa.

Paint Brush Hangers

Proper attention should be given to paint brushes, while in use as well as when laid aside. Two small clips made of tin or galvanized iron, and fastened to one side of each brush, as shown in Fig. 1, will provide a means to keep it from slipping into the paint pot. The brush can be hung on the side of the paint pot as shown in Fig 2. This will allow the paint to drain in the pot when the brush is not in use, and will also keep the bristles straight and prevent

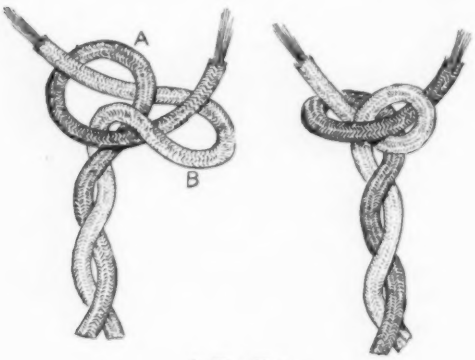
FIG. 1 FIG. 2

Clips on Paint Brushes

them from bending out of shape as they would if the brush were allowed to rest on the bottom.—Contributed by W. A. Jaquythe, Richmond, Calif.

A Knot for Flexible Lamp Cord

A knot that pulls tight and lays almost flat like a washer slipped over the cord is valuable in wiring up lamp

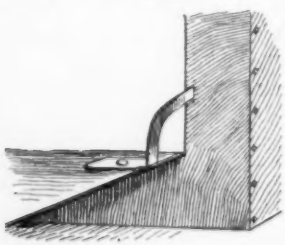


A Flat Knot

sockets and ceiling rosettes. Such a knot is made by turning cord A back in a loop, then turning the cord B back over A, passing the end under and through the loop A and then pulling tight. If the tie was not made in the right place it will come loose instantly by pushing on the cord.—Contributed by C. W. Goddard, Bellaire, Mich.

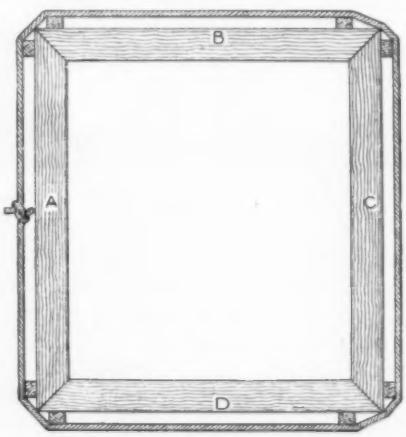
Oven Door Catch

Most oven doors are provided with a spring of some sort to overcome the jar of falling when opened. This spring often causes the door to rebound 3 or 4 in., and if the housewife is not careful the door will strike her arm as she reaches into the oven, and cause a bad burn. This rebound can be prevented if a small flat spring is bent and attached to the door with a stove bolt as shown in the accompanying sketch. When the door is down the end of the spring catches on the edge of the door frame, thus preventing its rebound. To close the door, simply press in on the spring and it will slide along the side of the oven as the door is closed. This little device will prevent many burns and is well worth the time and trouble it takes to make and attach it to the door.—Contributed by Carl P. Herd, Davenport, Iowa.



Method of Gluing Mitered Frame Joints

Have the miters cut perfectly true, then place the frame on a flat table with the miters in their proper positions. Place paper under the joints to keep them from sticking to the table while the glue is drying. Apply the glue to the miters and bring them as close together as possible. Tie a heavy cord about the frame as shown in the accompanying sketch. A trunk strap will do as well. Place eight small blocks of wood under the cord at the



Clamping the Frame

points marked A, B, C, and D, and push them towards the corners of the frame. This will tighten the cord and draw the miters firmly together. Leave in this position until dry, then remove the cord and drive nails across the corners, if necessary.—Contributed by G. B. Benford, Fair Haven, Vt.

¶Apply a coat of starch water on a dirty wall before painting. When dry the dirt and starch can be brushed or wiped off.

Home-Made Power-Driven Lawn Mower

The accompanying half tone shows a machine, a home-made affair, which was constructed to drive a lawn mower, yet it can be used for various other purposes. The frame of the machine is 4 in. thick, 13 in. wide and 4 ft. long, made of hard wood. The driving axle is 2 ft. long, thus making the track 2 ft. wide. The rear wheels are 16 in. in diameter, the face of each being 4 in. wide. Only one wheel is provided with lugs for traction, so in turning a curve the smooth face can slip. No differential is provided, as it is not necessary on such a light rig.

The lawn mower is attached to the front of the main frame similar to the fifth wheel on a buggy. The handle was removed from a common 18-in. lawn mower and an arch made from 1-in. pipe to fit in its place. This arch fastens on the outside of the wheels as shown in the illustration, using the same bolt that holds the wheels on the mower. There is a 1¼-in. tee placed in the center of the arch in which is screwed a short piece of 1-in. pipe to serve as a king bolt. The latter piece of pipe passes through a hole bored in the front end of the main frame, thus forming the fifth wheel of the machine.

A 1½-hp. gasoline engine, weighing 250 lb. with all its appliances, is mounted on the main frame. The whole machine is driven by two 3-in. belts, one on each side of the engine. Two idlers are used to keep the belts taut. The belts drive a countershaft which has a sliding gear for a 4-mile speed forward and a 3-mile speed backward, both operated by a foot lever.

The guiding is done by the lever held in the left hand as shown in the picture. The guiding chain is attached to the lower end of this lever.

When the machine is not in use for cutting grass, the mower is removed and a two-wheeled axle put in its place. The wheels on this axle have a 2-in. face and a diameter of 12 in. The axle is made of 1-in. pipe, 2 ft. long. The wheels have a band placed on the center of their faces to keep them from slipping when making turns. The engine can be used for sawing wood, grinding feed or running a washing machine.—Contributed by Herman A. Grimund, Bristol, Ill.

Gasoline Engine Driving Lawn Mower

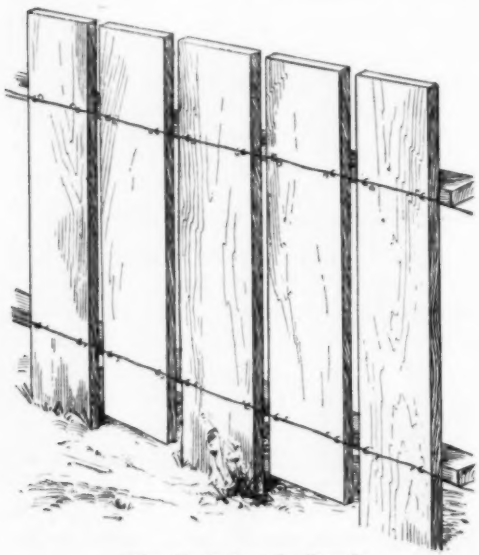
A Home-Made Garden Weeder

A home-made hand weeder for use about the garden is shown in the accompanying sketch. Grass and weeds can be quickly and easily cut or combed from about small plants by means of the sharp saw teeth. The end can be used as an individual weeder, trowel, or transplanter. It is made of a piece of steel of about the thickness of a garden trowel and 1 in. wide. Bend it and attach a handle, then file or grind in the sharp teeth as shown.—Contributed by W. A. Jaquythe, Richmond, Cal.

Saw Tooth Weeder

Holding Boards on a Fence

A board fence soon goes to rack and ruin after one or more boards fall from place. A large company having

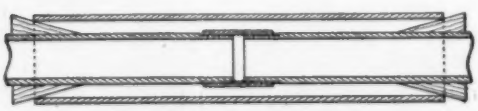


Wire Stapled to the Boards

branches in several cities, keeps its merchandise in enclosures fenced in with boards nailed perpendicularly on cross bars between posts. To prevent any boards from falling should they become loose, the company have adopted the plan shown in the sketch. A wire is stretched and fastened with staples driven in each board on the side opposite the crosspieces.—Contributed by J. J. O'Brien, Buffalo, N. Y.

Reinforcing Pipe Lines at the Joints

The scheme shown in the accompanying sketch will be of service to those who have occasion to connect



Prevents Binding at the Joints

up a pipe line across a stream or space when it is necessary to connect up the line before it is put in place.

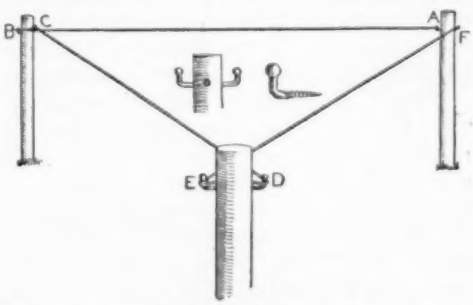
A piece of pipe somewhat larger than the pipe being connected is slipped over the line at each joint. After the joints are screwed together tightly, wedges with long tapers are driven between the pipes in such a manner that the tendency to bend in the joints will be prevented by the sleeve before the connection loosens with the strain.—Contributed by J. H. Cruger, Cape May City, N. J.

How to Utilize Old and Thick Paint

To utilize old and thick paint when a paint grinding mill is not at hand, grind the paint through an old meat cutter, using the nut butter grinder. Thin it with turpentine and oil. In this manner all accumulated leavings in paint cans can be used.—Contributed by J. P. Cowing, Chicago.

Post Hooks for a Clothesline

Secure several ½-in. lag screws, 5 in. long, forge the square head in the shape of a round knob, as shown in the small, center sketch, and bend the end up. Each post must be provided with two of these hooks, one opposite the



Clothesline Hooks

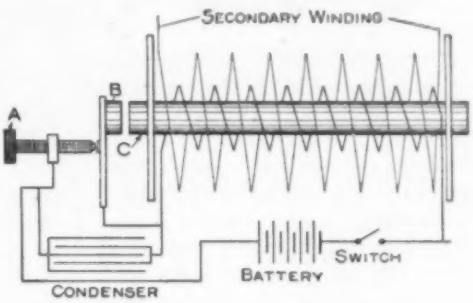
other, at the top end. One end of the rope is fastened at A, drawn taut around the hook C, thence to B and across to D, from D to E, E to F, and then tied.

¶Sprinkle unslaked lime along the comb of a roof, and the rain will dissolve it and carry it over the shingled surface, thus removing moss and accumulations of dirt.

How to Adjust a Spark Coil

Standard makes of spark or induction coils, when properly adjusted, consume nearly one-half ampere to each engine cylinder. If the contact points are screwed together too close, the current consumption will be increased with a less mileage than can be secured with the same battery with the coil properly adjusted. It is advisable in every case to adjust the coil until it will take no more current than is necessary. To do this use the ammeter either connected in the place left for the connection on the coil, or into the battery connection, so the current will flow from the battery through the ammeter to the coil. If the coil has a number of units intended for use with a multiple cylinder motor, place a piece of paper under all except one of the points while the engine is running. Adjust this point until the current taken is a minimum, without any tendency to miss explosions. If the engine will not run on the one cylinder, the current taken by each of the points may be determined by blocking this one point off with a piece of paper and noting the change in the current taken. It may be necessary to go over the operation a number of times to find the lowest consumption on which the engine will run properly. In most cases the coil vibrator will not need adjusting.

The method of construction of a spark coil is shown in the accompanying sketch. If its principles are thoroughly understood, its adjustment will prove quite simple. When the adjusting screw A is turned inward, forcing the vibrator B nearer the pole or core C, the rate of vibration will be increased, and when the screw is turned outward the rate of vibration is decreased. However, there are definite limits to the proper operation of the core C, at either loose or tight adjustments. The adjustment that would prove suitable for low speeds, may be very unsuitable for high speeds and vice versa. This may be applied to the strong and weak batteries. Therefore, when possible, it is advisable to attend to the battery rather than the coil adjustments. When the jump spark coil



Induction Coil with Condenser

is used it is advisable to have two sets of batteries controlled by a two-point switch. The vibrator B should vibrate with a rapidity sufficient to give a clear musical sound. Rapid vibration, except of course one that is excessive, will be much better for the battery than one that is slower. When the rate of vibration is reduced it increases to a certain extent the efficiency of a weak battery, as this allows time for the current to more fully saturate the windings of the coil. The vibrator should buzz only at the closing of the primary winding or circuit when the contact is made at the points of the commutator.

The object of the condenser is to reduce the sparks at the points of the primary winding and to generate them in the secondary winding much more brilliant and intense.

In selecting a coil it is necessary to see that it is suited to the type of battery or generator with which it is to be used. The best results cannot be obtained unless the coil and source are mutually suited to each other. This rule will hold good for all types of generated current, but is particularly true if the small dynamo is used in place of batteries.—Contributed by J. N. Bagley, Webber, Kan.

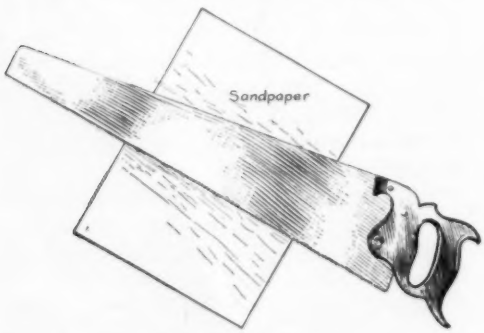
Home-Made Steak-Beater

I had a job to turn out a steak-beater on my lathe for a customer, and it looked good to me; so I experimented a little, turning out quite a number of them in different woods. The size adopted as the best is 3 in. in diameter and 8¾ in. long over all. The diameter at the depth of the grooves is 2⅜ in. The width of each groove from point to point is ⅜ in., with the end turned off rounding ½ in. long. The handle is 1¼ in. in diameter at the smallest place and 1⅝ in. near the end.

The beater should be turned from close-grained, well-seasoned wood. Hickory, pecan, osage orange and beech are good. Cut the grooves about the same angle as a V-thread. The end can be used as a potato masher.—Contributed by J. W. Brelsford, Houston, Texas.

Tearing and Folding Sandpaper for Use

Sandpaper can be torn quite easily by placing it under a fine-toothed saw, with the sand side down, and tearing up as shown in the accompanying sketch. This does not damage the saw

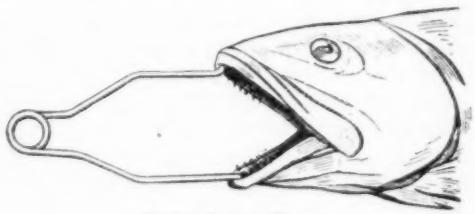


Tearing Sandpaper

and the sheets can be torn to any desired size convenient for use. If the paper is folded four double, better service can be had from it than by using it in single sheets. By thus folding two sides can be used and when worn, the two unused sides can be turned out. If the smooth side of the paper is chalked before it is folded it will prevent its slipping when in use.—Contributed by C. Purdy, Ghent, O.

Removing a Hook from the Mouth of a Fish

Fishermen who have trouble keeping the mouth of a fish open while removing the hook, will be interested in the little device shown in the accompanying sketch. The spring shown will do the work very nicely and the hook can be easily removed with a disgorger, thus saving many broken lines and cut fingers. This device is especially useful to the ladies who enjoy fishing, but dislike the operation of removing the hook.—Contributed by F. S. Cummings, Detroit, Mich.



Spring in the Mouth

Cutting Oil Grooves

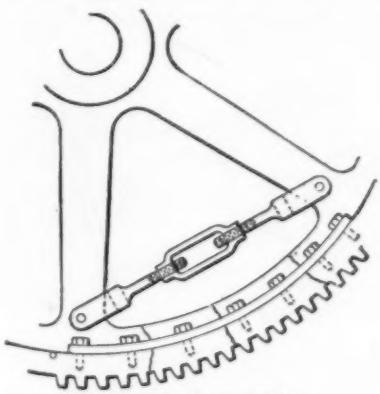
For some classes of work the ordinary oil groove is undesirable. For instance, a tight belt running down from a countershaft exerts a considerable pull on the upper bearing and a liberal oil groove, cut straight across the top, lessens the wearing surface, and hastens a renewal. However, plentiful lubrication must be provided for in some manner. A good way to cut oil grooves is to chuck the bearing, and with a boring tool having a round point cut a thread right through the box. The thread should be of a coarse pitch, say, ½ to 2 threads per inch, depending on the size of the bearing. Right and left threads can be cut, if

desired, in the same bearing, each starting from the oil hole and so cut that the oil will follow around the box when the shaft revolves.

An Emergency Gear Repair

The accompanying sketch shows a quick repair job of a spur gear. This gear is one of a series of drier gears on a large paper machine. The gear broke one day about 1:30 a. m., and at 6 a. m. the paper machine was again doing business, says a correspondent of the American Machinist.

It seems the company had no extra gears in stock, so the master mechanic was called in to repair the gear. He found two old steam-pump valve-rod heads and a turnbuckle which he arranged as shown in the sketch. While he was doing this the other men were

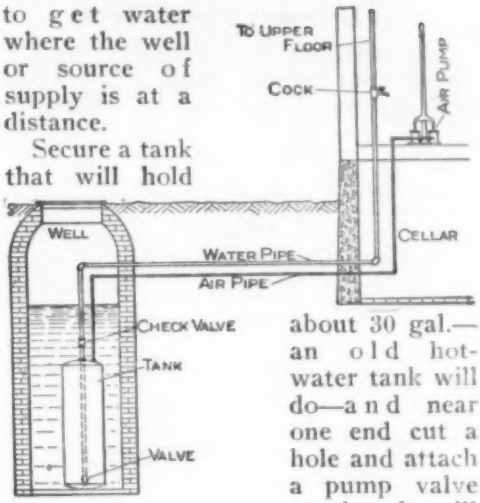


Turnbuckle on the Spokes

drilling and tapping the holes in the rim of the gear, also forming the straps, one on either side. These were bolted fast, then the turnbuckle screwed up, and the repair was complete. This repaired gear has been in use for two years and is still doing good work.

Home-Made Pneumatic Water System

A simple and inexpensive installation of a pneumatic water supply system for country homes is shown in the accompanying sketch. In cold and stormy weather it is a great convenience, as it is not necessary to leave the house to get water where the well or source of supply is at a distance.

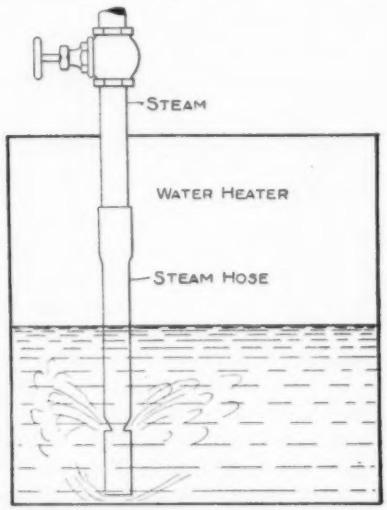


Secure a tank that will hold about 30 gal.—an old hot-water tank will do—and near one end cut a hole and attach a pump valve so that it will let the water into the tank, but close when it has a back pressure. This tank is to be set upright in the well, with this valve near the bottom as shown in the sketch. The supply pipe should be put into the tank and run to within about 1 in. of the bottom. A check valve is put on the pipe near the tank, then the connection made to the house. The water pipe should be underground and deep enough to prevent freezing in cold weather. Now attach a $\frac{3}{8}$-in. air pipe as shown and connect it to an air pump in the house. An old bicycle pump will do if you have nothing better. A valve is attached to the pump so the air can be let off when necessary.

The tank, being under water, fills itself as soon as the air valve is opened. When it is full the valve is closed and a pressure put upon the water by means of the pump. This pressure forces the water through the supply pipe into the house, where it can be drawn off through taps as wanted. When the tank is empty it is filled again by letting the air pressure off at the air valve. When full, close the valve and pump air as before. The simplicity, ease of operation, and low cost of installation of this pneumatic system should commend it to any one in need of such a device.—Contributed by H. A. Carmichael, West Lorne, Ont., Canada.

A Noiseless Water Heater

A noiseless water heater that is easily and quickly made is shown in the accompanying sketch. Secure an

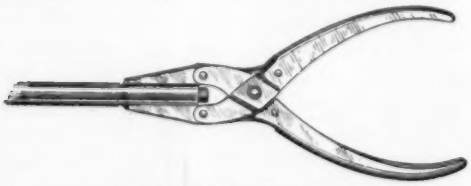


Steam Hose on the Pipe

old piece of steam hose and cut it out about 6 in. from one end as shown. Fasten the other end to the steam pipe and the heater is complete.

How to Cut Water Gauge Glasses

Where a short length of tube is to be cut off I proceed in the following manner: I mark the tube at the point to be cut with a three-cornered file, making nicks exactly opposite each other, then cut a hardwood plug and shape it to fit in the tube up to the marks. Some rubber or other soft material is placed on the tube to prevent it being crushed easily and then I grasp it



Breaking Off a Short Piece

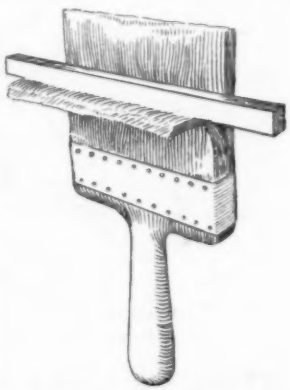
firmly with a pair of pliers as shown in the sketch. The short piece is easily broken off.—Contributed by Frank Lacina, Canby, Minn.

Color of Sparks

The color of the sparks given off by an emery wheel is a guide to the kind of metal being ground. Sometimes this is the most easy and handy way of distinguishing tool steels. Cast iron gives off dull red sparks and they stay close to the emery wheel. Wrought iron gives a spark similar to cast iron in color, but more like the spark from mild steel, which is bright yellow and flies from the wheel considerably. Self-hardening tool steel and the tungsten alloy steels make a thick shower of dull sparks, very much like the cast-iron sparks in color.

Care of Calcimine Brushes

Brushes used for calcimining will come apart if proper care is not taken to prevent them from rot, rust and drying out. If the brush is in continuous use there is danger of the bristles becoming rotten at the roots, as well as of rusting the metal binding, and if it is laid away for a time the drying and shrinking will cause it to come apart. All these troubles can be prevented if the brushes are treated in the following way: When the brush is new, or comparatively so, it should be thoroughly dried after being washed clean, then a mixture of the best spar or floor varnish and turpentine in equal parts should be poured into the binding and roots of the bristles until it has soaked through.



The manner in which this can be accomplished is shown in the accompanying sketch. Hold the brush in a vertical position with the handle down,

then part the bristles in the middle with a piece of sheet metal or a long blade of a knife. Slowly pour the mixture along the roots of the bristles until it has soaked through all around. The varnish should be warm, but not hot, to enable it to thoroughly soak in when poured into the brush. Three days at least will be required for the varnish to dry, and during this time the brush should be kept in a vertical position with the handle down. This treatment should be repeated every time there is indication of the bristles loosening, but if done thoroughly at first it is all that will be required.—Contributed by Samuel Nelson, Chicago, Ill.

Hose Fastener

A wrought-iron nail makes a very good fastener for a hose band. It can be drawn tight and will remain so, is much stronger than wire, and takes

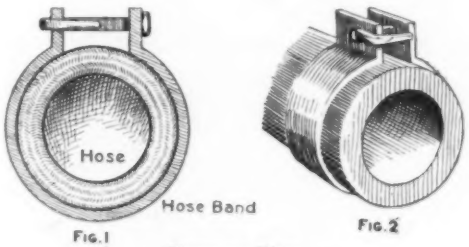


FIG. 1 FIG. 2

Clamp on Hose

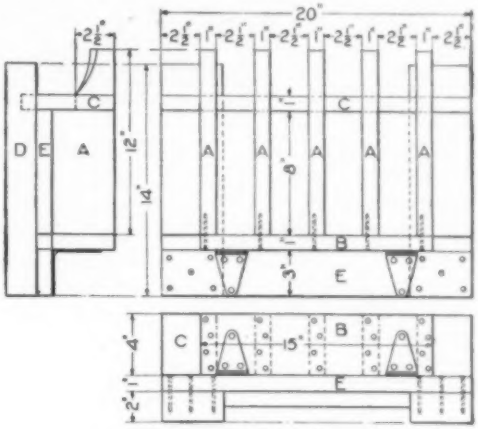
much less time and trouble to adjust than a short or rusty bolt. Figures 1 and 2 show plainly the method of attaching it to the band.—Contributed by J. M. Kane, Doylestown, Pa.

Mixing Starch with Calcimine

Select a good grade of calcimine, that to be mixed with hot water preferred. While the mixture is hot stir in 1 pt. of cooked starch such as is used in a laundry. The addition of the starch not only keeps the calcimine from drying out quickly, but it helps the mixture to cover the surface. —Contributed by Fred L. King, Islip, Long Island.

An Easily Made Concrete Brick Machine

Brick, which are a necessity upon every farm, can be easily and cheaply molded in spare moments by the use



Details of the Brick Forms

of the simple machine shown in the accompanying detail drawing.

To build, first secure five pieces of hardwood lumber, A, 1 by 4 by 12 in., and sandpaper the sides smooth. Shape a handle on one end of each and notch as shown in the end view. These five pieces are nailed to the piece B, which is 4 in. wide and 15 in. long. They should be spaced exactly 2½ in. apart, which is the thickness of an ordinary brick.

Piece C is now cut 6 in. wide and 20 in. long and notched 2½ in. deep at the top so that the division strip will set down into the notches. Two crosspieces, D, are cut 15 in. long and of 2 by 4-in. stock. Nail the piece E, which is 3 in. wide and 20 in. long, to these crosspieces as shown. The piece B is hinged to E so that the division strips, A, attached to the piece B may be raised upright and thus free the molded brick. Nine inches from the piece E fasten the piece C to the cross strips. This must be placed upright as shown in the illustration and may be fastened to the cross strips with small brackets to make it rigid. As this piece is 6 in. wide it must be cut out 1 in. at the bottom so as to set down upon the cross

strips and yet have the top level with the top of the division pieces A, so that the tops of the brick may be struck off smooth with a straight edge.

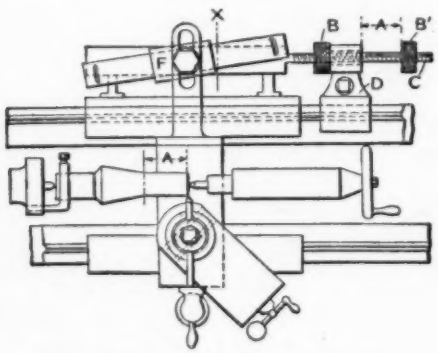
The brick are molded on a pallet which is 8 in. wide and 20 in. long. It is not fastened in any way so that it may be lifted out with the brick easily. The space for each brick is thus 2½ by 4 by 8 in., which is the standard size.

The operation is simple. Have the machine in the position illustrated, tamp the mixture into the spaces for the brick and level the top off with a straight edge. The division plates are then raised by taking hold of the part that projects beyond the board C, and lifting the whole section, leaving the brick free and on the pallet. This may then be picked up with the brick on it and set away to dry and another pallet placed in the machine, thus enabling the operator to use the same machine continuously.

All the parts of the machine should be treated to several coats of linseed oil and allowed to dry thoroughly before using, so as to render the wood more impervious to moisture and danger of warping. The concrete must not be made very wet, else it will not stand up when the mold is removed from the "green" brick. The best mixture is to use one part cement to four parts of sand or fine gravel and then wet the mixture until it is the consistency of thoroughly damp sand. Cure the brick for the first few days by covering with wet blankets. This prevents the hot sun from reaching the brick for a while, thus insuring satisfactory results.—Contributed by A. A. Houghton, Northville, Mich.

Cutting a Straight-End Taper Tap

It is sometimes amusing to see the simple manner in which some apparently hard problems are solved, says a correspondent of the American Machinist. One day the foreman received a drawing of a tap which was straight for 2½ in. and then tapered for about the same distance. The taper was at least 2 in. to the foot. Turning up the tap blanks was a simple matter, but to cut the threads was quite a different proposition. Every man was busy trying to solve the problem, but it remained for a "cub" to accomplish this and he did it without any effort on his part.



Lathe Device for Cutting Taper Taps

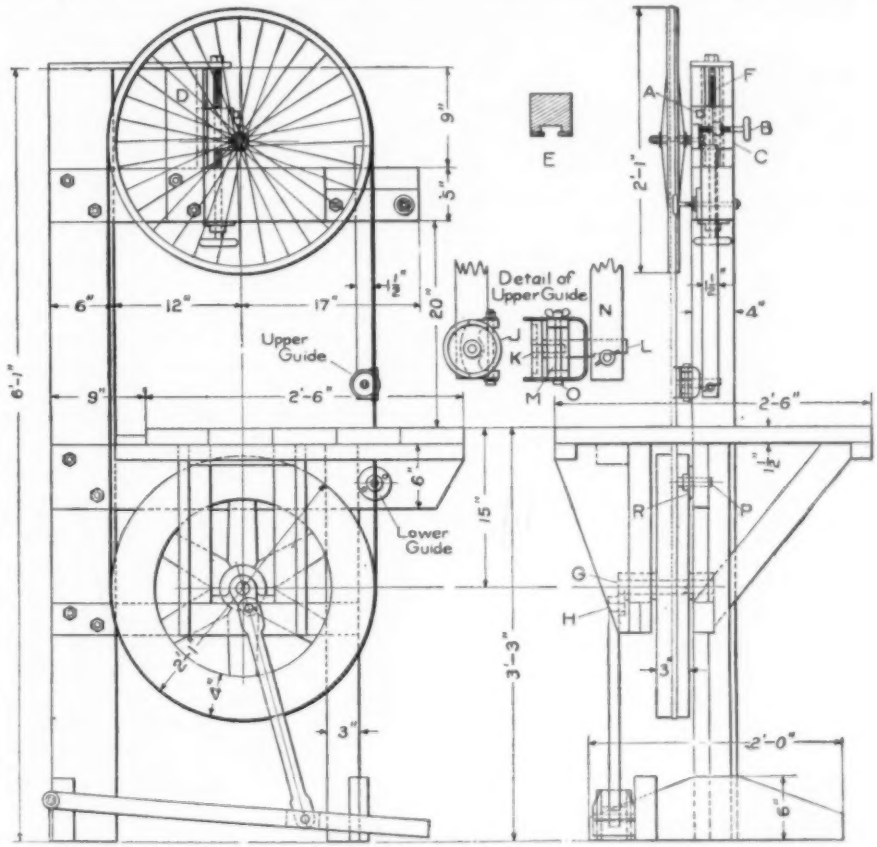
The youngster was roughing out a number of small taper taps on a lathe and when they reached the man who did the finishing, he found that they were straight for a short distance on the end. It was soon discovered that the boy had not adjusted the nuts BB^1 properly and the play here was about equal to the length of the straight portion on the end of the tap. It then occurred to the foreman to try to cut the taps in a similar way. By adjusting the clamp D to the proper position and then backing up the nut B^1, a distance equal to the straight part of the tap blank it was found to work quite satisfactorily.

By looking at the sketch it will be noted that as long as the screw C is free to pass through the clamp D the work will be turned straight, but as soon as nut B^1 strikes the clamp D, the cross slide will then take the course set by the taper attachment.

A Home-Made Band Saw

Detail drawings are here given for the construction of a foot-power band saw. This saw will prove quite serviceable in a small wood-working shop where the material to be sawed is not too heavy.

The frame is made of standard sizes of hardwood timber. The joints can



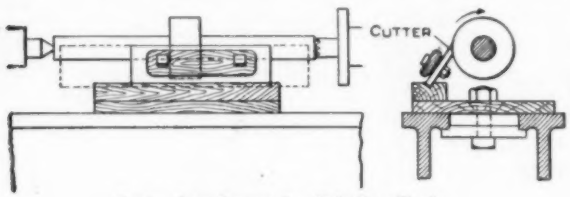
Details of the Band Saw

be halved or mortised and they should be glued and bolted securely together. Care should be taken to get them together perfectly square, else one will have trouble in lining up the saw wheels.

The top wheel is an ordinary front wheel of a bicycle which has the tire groove filled to a level with leather, then covered with a rubber belt. The axle is mounted on a casting which swings on the bolt A. Its angle is adjusted by means of the screw B, in the block C. This block slides in a groove in the upright piece D, a cross-section view of which is shown at E. The screw F serves as a vertical adjustment.

The bottom or drive-wheel is constructed as shown and it also should have a rubber band glued to it. It is mounted on a shaft which runs in a roller or ball bearing. A crank, G, which has a 2-in. throw, is fastened at one end of the shaft, and connects to the treadle arm. The treadle is hinged to the frame, and the pin H, which connects the arm to the crank, should be so made as to be easily removed when changing saws.

The upper guide consists of a revolving brass wheel, J, with a steel pin, K, fastened in it, which turns in the end of the shaft L, as shown. This shaft is fastened in the guide frame M and has one end flattened in order to be clamped securely in the guide post N. The V-shaped piece of band iron is slotted in the ends for the saw and it is fastened to the casting M by means of a clamp screw, O. The holes in the band are slotted to permit of adjustment.



Lathe Attachment for Grinding Tools

The lower guide consists of a short length of ¾-in. diameter, cold-rolled steel bar, P, which is held in the casting R by means of a setscrew.

This machine is very simple in design and easy to construct. It can be run by power by simply attaching a pulley to the drive-wheel axle in place of the crank.—Contributed by A. H. Petri, Philadelphia, Pa.

Flat Side on a Rubber Stamp Handle

On all rubber stamps having knob handles cut a flat place on the thumb side with the bottom of the letters toward you, and the right side up can be determined instantly without looking at the face of the type. The accompanying sketch shows where the flat side is to be made on the knob.—Contributed by W. A. Humphrey, Columbus, O.

Sharpening Cutters for Wood Planers

The sharpening of cutters for woodworking machines is often a laborious task and the pattern-maker will welcome any time or labor saver in this line, says a correspondent of the American Machinist.

The sketch shows an arrangement adapted to a wood-turning lathe by which cutters can be ground uniformly hollow. For convenience in handling, the cutter is bolted to a wooden holder and a rest for the blade to slide along is constructed either as shown or it may be connected to the existing tool carrier. This is fixed at the back of the machine unless the direction of rotation can be reversed.

The grinder is a wooden collar, say 5 in. in diameter and 2 in. wide, mounted on a spindle which should be long enough to allow the cutter to slide the full length on it. After truing up, cover the surface of the collar with thin glue and sprinkle powdered emery evenly over it. The grinding is done dry at a fair speed, care being taken not to burn the blades. The finishing edge is obtained on the oilstone.

By using different shapes of grinders, with suitable rests, gouges and other tools can be sharpened rapidly. The cost of the apparatus being insignificant, will make it appeal to small shops unable to buy an expensive grinder.

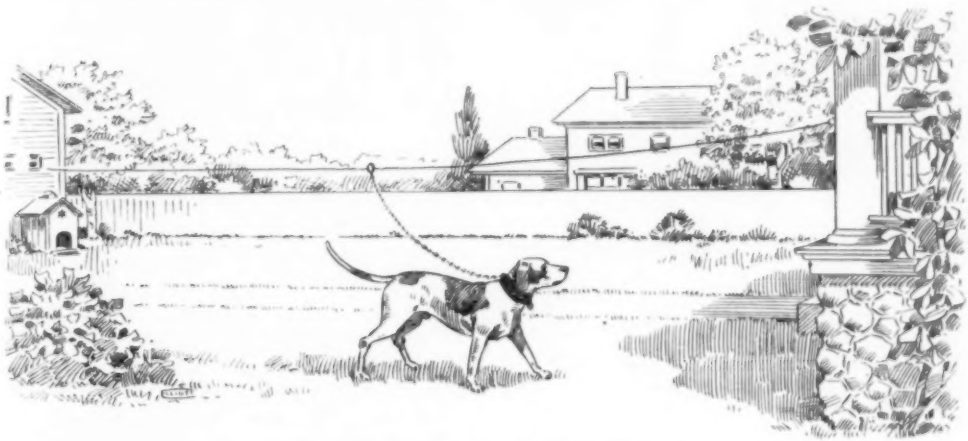
How to Mix Red Lead Paint

To mix red lead paint easily and rapidly use a revolving barrel butter churn. It is well known that red lead is a most stubborn pigment and hard to mix with hand paddles. By using a barrel churn to mix the paint an old painter will be surprised at the increased spreading qualities of the paint so mixed over that mixed with hand paddles.—Contributed by J. P. Cowing, Chicago.

AMATEUR MECHANICS

How to Chain a Dog

A good way to chain a dog and give him plenty of ground for exercise is to stretch a clothesline or a galvanized wire between the house and barn on which is placed a ring large enough to slide freely. The chain from the dog's collar is fastened to the ring. This method can be used for tethering a cow or horse, the advantage being in the use of a short tie rope eliminating the possibility of the animal becoming entangled.—Contributed by Chas. W. Thiede, Denver, Colo.

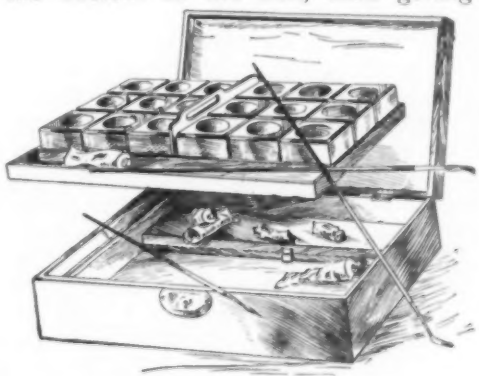


The Dog Has Plenty of Room for Exercise

Water Color Box

There are many different trays in the market for the purpose of holding water colors, but they are either too expensive for the average person or too small to be convenient. I do a great deal of water color work and always felt the need of a suitable color dish. At last I found something that filled my want and suited my pocketbook. I bought 22 individual salt dishes and made a box to hold them as shown in the illustration. This box has done good service.

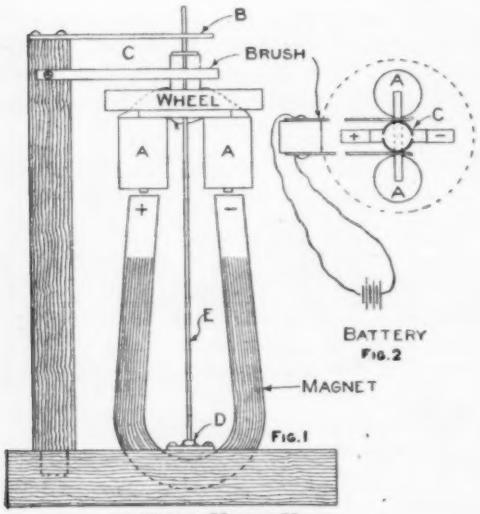
Some of the advantages are: Each color is in a separate dish which can be easily taken out and cleaned; the dishes are deep enough to prevent spilling the colors into the adjoining ones; the box can be made as big or as small as your needs require. The tray containing the color dishes and brushes rests on ¼-in. round pieces 2¼ in. from the bottom of the box, thus giving ample store room for colors, prints, slides and extra brushes.—Contributed by B. Beller, Hartford, Conn.



Color Trays Made of Salt Dishes

A Small Electric Motor

The drawing herewith shows a simple electric motor which can be easily constructed by any boy who is at all handy with tools. I made this motor



Electro-Magnet Motor

many times when a boy and can say that if carefully constructed it will run with greater rapidity than the more expensive ones.

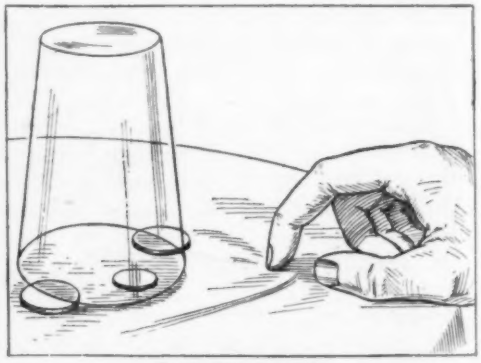
A common magnet which can be purchased at any toy store is used. The one shown is 3½ in. in length. The armature core is a strip of $\frac{1}{16}$ by ¼-in. iron, 2¼ in. long, bent U-shaped and fastened to the wood flywheel. Each leg of the armature is wound with 10 ft. of No. 24 gauge magnet wire. The commutator is made from an old 22 cartridge filed into two equal parts, each being a half circle, both of which are made fast to a collar on the shaft E. Each half of the commutator must be insulated from the other half. The collar can be made by wrapping paper around the shaft until the required size is obtained.

The top end of the shaft runs in a hole bored in a brass support, B, which is screwed on the end of a piece of wood mortised in the base, as shown in Fig. 1. The lower end of the shaft runs in a glass bead, D, which is fastened to a small piece of brass with sealing wax. The small brass piece is fastened to the base with screws. The bead should not have an eye larger in diameter than the shaft. The shaft is made from an old discarded knitting needle. The brushes are fastened to each side of the upright piece of wood supporting the brass bearing B.

The connections to the battery are shown in Fig. 2. Each half of the commutator C is connected to the coils AA as shown in Fig. 1.—Contributed by J. M. Shannon, Pasadena, Calif.

Moving a Coin Under a Glass

Place a penny or a dime on a tablecloth, towel or napkin and cover it over with a glass in such a way that the glass will rest upon two 25 or 50-cent pieces as shown in the sketch. The coin is made to come forth without touching it or sliding a stick under the edge of the glass. It is only necessary to claw the cloth near the glass with the nail of the forefinger.



Removing the Coin

The cloth will produce a movement that will slide the coin to the edge and from under the glass.

¶ When playing loud and harsh records on a phonograph the music is often spoiled by the vibration of the metal horn. This may be remedied by buckling a valise or shawl strap around the horn, near the center.

Making Photo Silhouette Brass Plaques

Secure a brass plate having a smooth surface the right size for the photograph and cover it with a coat of paraffin. This is done by heating the paraffin in a vessel hot enough to make the wax run freely, then pouring the liquid over the entire surface of the brass.

When the paraffin has cooled sufficiently the outlines of the photograph must be drawn upon its surface. There are three ways of doing this: First, the photograph can be traced on tissue paper and then retraced on the paraffin surface. The exact outlines of the photograph can be obtained this way without destroying the print. Second, if you have several copies of the photograph, one can be utilized by tracing direct to the surface of the paraffin. In using either of the two methods described, carbon paper must be placed on the paraffin before the tissue paper or photograph is laid upon it. Third, cut out the outlines of the photograph and lay it on the paraffin surface, then trace around the edges with the point of a needle or sharp point of a knife. The outlines drawn by the first method are cut through the paraffin in the same way. The paraffin is carefully removed from the inside of the lines, leaving the brass surface perfectly clean, as is shown in Fig. 1.

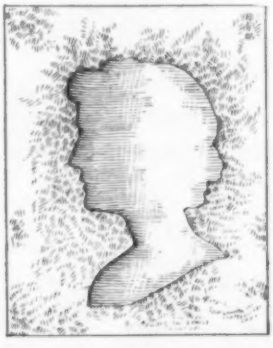


Fig. 1
Waxed Brass Plate

The exposed part of the plate is now ready to be etched or eaten away to the right depth with acid. The acid solution is made up of 1½ parts muriatic acid and 2 parts water. The mixture should be placed in a glass or earthenware vessel. If the plate is a small one a saucer will do for the acid solution. Pour the acid on the plate where the paraffin has been removed and allow it time to etch. The acid should be removed every five minutes to examine the etching. If any places show up where the paraffin has not been entirely removed they must be cleaned so the acid will eat out the metal. When the acid solution becomes weak new solution must be added until the proper depth is secured. Rinse the plate in cold water, stand in a tray and heat it sufficiently to run off all the paraffin. Polish the plate by rubbing it with a piece of flannel.

Fig. 2
Finished Plaque

The plaque can be given a real antique finish by painting the etched part with a dull black paint. Drill a small hole in each of the four corners, being careful not to dent the metal. The plaque is backed with a piece of wood ¾ in. thick, the dimensions of which should exceed those of the brass plate sufficiently to harmonize with the size of the plaque. The wood should be painted black with the same paint used in the plaque. Paint the heads of four thumb tacks black and use them in fastening the plaque to the board. The finished silhouette will appear as shown in Fig. 2.—Contributed by John A. Hellwig, Albany, N. Y.

¶Automobile headlights should be set to throw the light straight ahead, not pointed down at the road at an angle.

Wood-Working for Beginners

By IRA S. GRIFFITH

CHAPTER VI

Squaring up Mill-Planed Stock

Practically every lumber yard carries in stock lumber that has been mill-planed on two surfaces to stock thick-

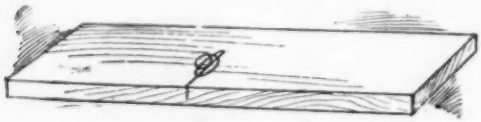


Fig. 27—Trace Marks

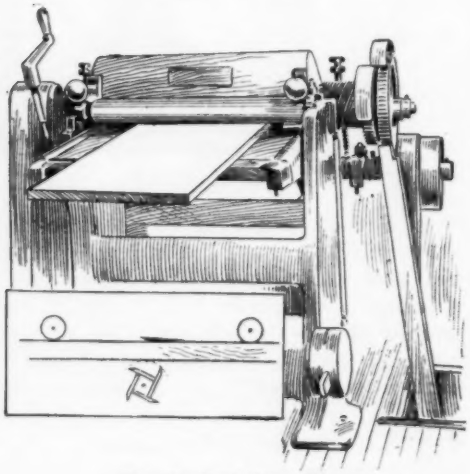


Fig. 28—Surfacing a Board

nesses. Wood-workers can specify the thickness wanted for the work they have in hand and thus avoid much of the drudgery necessitated by planing up stock entirely in the rough as it comes from the sawmill.

The first broad surface and the first edge planed have a peculiar use and definite names. The first surface is called face side or often working face. The first edge is called face edge or frequently joint edge. These are marked to distinguish them from the others, as shown in Fig. 27. They are the only ones marked. From these two faces, and these only, all testing is to be done, the beam of the try-square and the head of the gauge being held against one or the other.

In selecting these faces, the better broad surface and the better edge are taken, if the object is to consist of but one piece. If it is to consist of several parts, such as a table or a chair, the poorer surfaces are to be selected for faces. Where several parts are to be joined, the faces are turned "in" because, being the first prepared, they are more accurate than the others. Any inaccuracies in the first surfaces will appear in the others, since they are worked from the first surfaces. Some inaccuracies may be present in the second surfaces which are not present in the first set. For this reason the face sides when joined together are more likely to make close-fitting joints than the others. Frequently there is little choice of surfaces. Generally, however, slight streaks of sapwood, smoothness of surface, etc., will be the determining factors.

Planing First Surface

Should the piece not be of equal width and thickness, select the broad surface which is desired for face side.

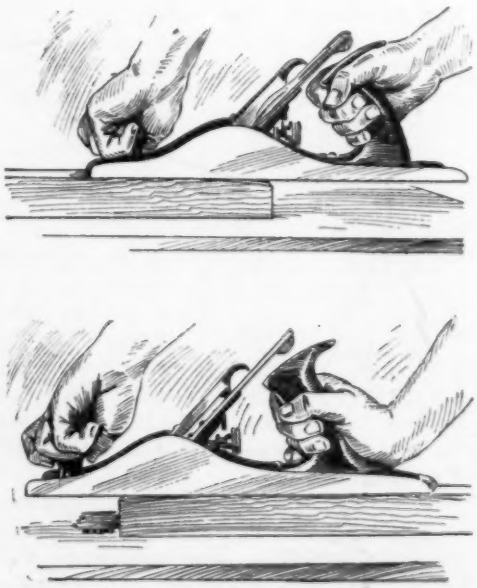


Fig. 29—Starting the Plane and Finishing the Stroke

With the smooth plane remove the mill-marks from it. Mill-marks are the little ridges and hollows which extend across every piece of mill-planed lumber. In mill-planing, a series of knives, two and sometimes four, are caused to revolve very rapidly above or below the board, sometimes both above and below, as it passes through the planer, shown in Fig. 28. If the knives are properly set, revolve very rapidly, and the board is not made to travel over the planer bed too rapidly, these marks are hardly noticeable. They must be removed with the hand plane, however, from any lumber that is to be used for interior finish or cabinet work. If they are not removed, the filler or stain will tend to "bring out" and emphasize every hollow and thus give the wood an ugly, streaked appearance.

Since it is difficult to tell where the smooth plane has or has not cut in removing these marks, it is a good plan to make a series of light pencil lines across the board at frequent space intervals before beginning to plane.

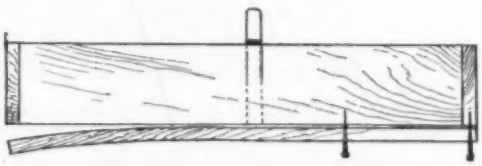


Fig. 31—Nailing Out "Dished" Board

When these have been removed the mill-marks will have been removed, too.

In planing, press firmly on the knob in starting and upon the handle in stopping the stroke, or the ends of the board will be lowered too much, as shown in Fig. 29. If the board is a long one, it will be necessary to start and stop some of the strokes in its middle. That no marks may show where this takes place, the shavings must be "feathered." This is done by lowering the toe of the plane first in starting and by raising the heel of the plane gradually as the completion of the stroke is neared. This is shown in Fig. 30.

A board will very often become warped or dished after having been

Fig. 30—Lifting Plane on the Return Stroke

planed level at the mill. The nature of the work in which it is to be used will determine whether or not this first surface is to be leveled or merely smoothed. If dished much, and the work requires a level surface, a new piece or a thicker piece will be needed. In many cases the dish will "nail out" so that the first surface needs only smoothing. This is illustrated in Fig. 31, where a bottom board is being nailed to the side of a box. When this

Fig. 32—Sighting Lengthwise

surface has been sufficiently smoothed, mark it for a face side.

Planing First Edge

Select and prepare one of the edges for a face edge. Place the piece against

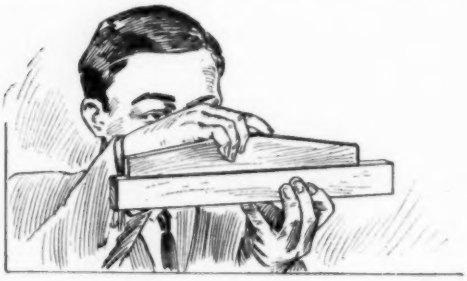


Fig. 33—Using a Wood Straightedge

the bench stop or in the vise. The jointer is usually used for edge planing after the jack-plane has been used to remove the roughness. After a few strokes, hold the board toward the light, close one eye and look along the edge, Fig. 32, to see whether it is straight or not. Practice will soon enable one to know when the edge is straight. At first it may be well to use a straightedge test in addition to the sight test. This is done by placing something having a straight edge as shown in Fig. 33, holding the board and straightedge between the eye and

Fig. 35—End View of Plane

the light so that any unevenness may show plainly.

The second test is to place the try-square as in Fig. 34. Hold the beam firmly against the face side and make the test at a sufficient number of places along the edge to show its true condition. Should light show under the blade, note where it is, place the piece in the vise again and move the plane over to the side opposite that at which the light appeared, Fig. 35. Take off no more shavings in planing this edge than are absolutely necessary to get it straight and square. The final stroke should be taken the full length of the board and the shaving should be very

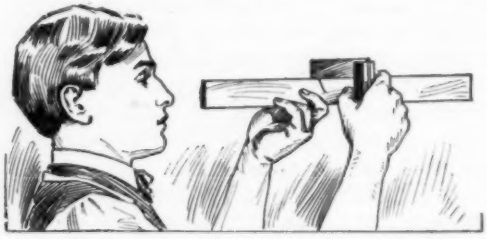


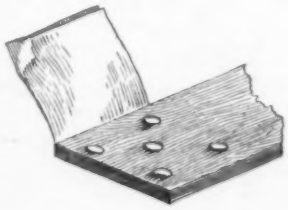
Fig. 34—Try-Square on First Edge

thin. Mark this edge as in Fig. 27. It is to be known as the face edge.

(To be Continued.)

Sad Iron Polisher

A small amount of wax is necessary on an iron for successful work. The wax is usually applied by hand to the heated surface of the iron. A much better and handier way is to bore five or six holes in one end of the ironing board to a depth of half its thickness, filling them with wax, beeswax or paraffin, and covering them over with two thicknesses of muslin. The rubbing of the hot iron over this cloth absorbs just enough of the wax to make the iron work smoothly. When the supply of wax is exhausted it can be easily renewed.—Contributed by A. A. Houghton, Northville, Mich.



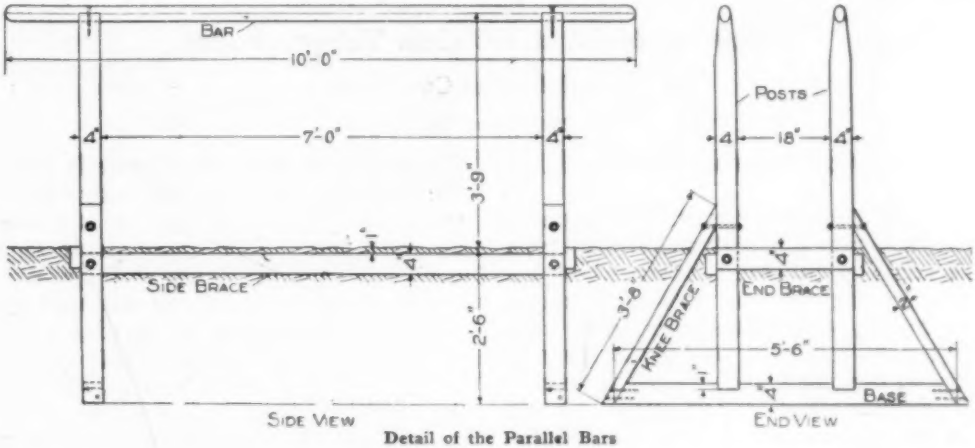
An Outdoor Gymnasium

Part II—Parallel Bars

Parallel bars hold a high place in the affection of those who frequent gymnasiums as the best apparatus for development of the back and shoulder muscles, as well as a promoter of ease and grace of movement. The outdoor "gym" can have a set of these bars with very little more labor than was required for the horizontal bar.

The material required is as follows: 4 posts, preferably cedar, 4 in. square and 6 ft. long; 2 base pieces, 4 in. square and 5½ ft. long; 2 cross braces, 2 by 4 in. by 2 ft. 2 in. long; 2 side braces, 2 by 4 in. by 7 ft. 8 in. long; 4 knee braces, 2 by 4 in. by 3 ft. 8 in. long; 2 bars of straight grained hickory, 2 by 3 in. by 10 ft. long; 4 wood screws, 6 in. long; 4 bolts, 8 in. long; 8 bolts, 7 in. long and 1 doz. large spikes.

To make the apparatus, lay off the bases as shown in the end view and bevel the ends at an angle of 60 deg. Chisel out two notches 4 in. wide and 1 in. deep, beginning at a point 9 in. from either side of the center. These are to receive the lower ends of the posts. Bevel two sides of one end of each post down to the width of the finished bar—a little less than 2 in. Cut notches in these ends to receive the oval bars. Bevel the ends of the knee braces, as shown in the diagram, and fasten the lower ends to the beveled ends of the bases with the spikes. Fasten the upper ends of the knee braces to the uprights with the 8-in. bolts put through the holes bored for that purpose, and countersinking the heads. Lay the whole end flat on the ground and make a mark 2½ ft. from the bottom of the base up along the posts, and fasten the



Detail of the Parallel Bars

end braces with their top edges flush with the marks, using four of the 7-in. bolts. Finally toe-nail the base into the ends of the posts merely to hold them in position while the whole structure is being handled.

Two endpieces must be made. These sets or ends of the apparatus are to be buried in trenches dug to the depth of 2½ ft., with the distance between the two inner surfaces of the posts, which face each other, of 7 ft. After the trenches are dug, additional long, shallow trenches must be made connecting the posts to receive the side braces. The function of these side braces is to hold both ends together solidly. It is necessary to bury these braces so they will be out of the way of the performer. The side braces are bolted to the posts just below the cross braces, so the bolts in both will not meet. The bars

are dressed down so that a cross section is oval as shown in the end view. They are to be screwed to the notched ends of the uprights with the 6-in. screws. The holes should be countersunk so they can be filled with putty after the screws are in place. The bars should be well oiled with linseed oil to protect them from the weather, and in the winter they should be removed and stored.

Every piece of wood in this apparatus can be round and cut from trees, except the bars. If using mill-cut lumber, leave it undressed, and if using round timber leave the bark upon it as a protection from the weather. It is well to paint the entire apparatus, save the bars, before burying the lower part of the end pieces. The wood so treated will last for years, but even unpainted they are very durable. Be sure to tamp down the earth well about the posts. A smooth piece of ground should be selected on which to erect the apparatus.

(*To be Continued.*)

How to Make a Wireless Telegraph Set

Part III—The Condenser

By Arthur Moore

Spark Coil Construction—Part II

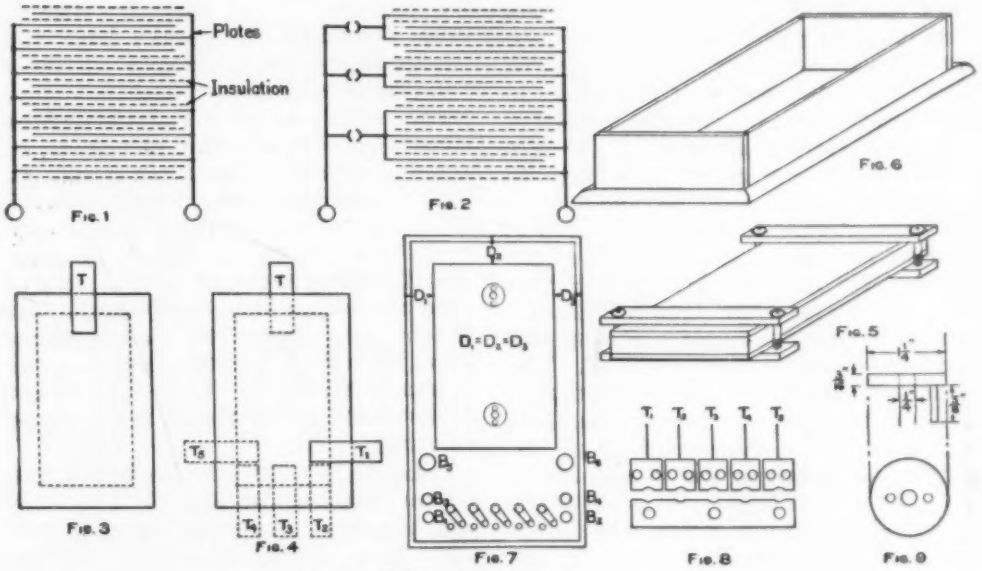
After your coil proper is completed you can proceed with the construction of some of the other parts while you are waiting for the various coats of varnish to dry on the containing case. It would be well to construct the condenser next as it will require some time to dry thoroughly, and your coil will be ready to assemble when the remaining parts are complete. The purpose of the condenser is to reduce the spark at the contact in the interrupter, which increases the life of the contact and at the same time causes a more rapid change of current in the primary, thus increasing the voltage induced in the secondary. A condenser consists of two electrical conductors separated by an insulating material called the dialectric. The capacity of a condenser depends upon the area of the conductors, their distance apart, and the kind of material or dialectric separating the plates. You will need at least 2,400 sq. in. of exposed plate in a condenser suitable for the coil you are constructing. Now instead of attempting to build the condenser by using only two sheets, you can reduce its size by increasing the number of plates and arranging them as shown in Fig. 1. In determining the size of plates to use in the condenser you should bear in mind the fact that it would be desirable to mount the condenser in the sub-base of your coil. The upper containing case was 10¼ in. long, and approximately 6 in. wide, outside dimensions. This case should be mounted upon a second case about 11 in. wide, and 17 in. long. If it is made of ¾-in. material that will give inside dimensions of 9½ by 15½ in. You will want to allow at least ½-in. clearance at both sides and one end, and about 3 in. at the other end where connections can be made to the condenser. This will give you the dimensions of your insulating sheets 8½ in. wide and 12 in. long. The tinfoil that you will use as the conductors should be cut into sheets 6 by 8 in. Each of these sheets will have an area of 48 sq. in. and since there is a total of 2,400 sq. in. required you will need 50 sheets. Twenty-four of these sheets will be connected to one terminal and the remaining 25 to the other. You may think that there will be 50 positive and 50 negative plates required, but each plate will have both surfaces exposed as shown in Fig. 1, and only half as much tinfoil will be required in a condenser of this type as in one consisting of only two large sheets.

Procure a small quantity of the very best grade of thin bond paper and cut

about 60 sheets 8½ in. wide, and 13 in. long. These sheets of paper should be boiled in paraffin for about one hour and hung up to drain. The paraffin should be real hot when the sheets are removed so that it will drain off easily, resulting in a uniform thickness throughout. When they have cooled, cut ½ in. from each end, making the sheets 8 in. wide by 12 in. long. Now cut from some tinfoil 50 pieces 1 in. wide and 4 in. long, that are to be used in making connections to the various sheets or plates of the condenser.

connections of these switches will be taken up in a future chapter.

To build up your condenser, you should proceed as follows: Lay a sheet of the paraffin paper on a smooth board and place a sheet of the tinfoil in the center of this piece of paper. Take one of the small tinfoil connecting strips and put it in place as shown in Fig. 3. Now place a second sheet of paper in place and run a squeegee print roller over it, applying quite a little pressure, thus removing any air that might exist between the foil and paper.



Details of a Condenser

It is impossible to predetermine the exact capacity that will give the best results, and for this reason it would be best to divide your condenser into a number of parts so that the capacity can be varied. Such an arrangement is shown in Fig. 2, which amounts to connecting a number of condensers in parallel. To construct your condenser so that it will correspond to the above arrangement you should divide the connections to one set of plates into, say, five groups, and these various groups can be connected to switches on the top of the lower base of your coil. The construction and

Place a second sheet of tinfoil in place and make the connection to it as shown by full line in Fig. 4. Continue in this way until you have a total of 10 sheets in place. The odd numbered sheets being connected together at the point T and the even numbered sheets connected together at the point T_1, Fig. 4. The odd numbers of all the remaining sheets should be connected to the common terminal T, and the even numbers should be grouped, five sheets to the group, and connected to the terminals T_2, T_3, T_4, and T_5. The terminals should be arranged as shown in Fig. 4, so that there is no likelihood of

them coming in contact with each other. After all the plates are in place, lay three or four sheets of paper on the outside of the condenser and clamp it between two boards as shown in Fig. 5. The terminals formed of the tinfoil connecting strips are very weak and can be easily broken off when handling, so that they should be strengthened by folding some pieces of very thin brass over them, the end of the brass strips being slipped between the plates when the condenser is under construction.

You should now heat the condenser until the paraffin softens, at the same time increase the tension in the screws, and then allow it to cool. It might be well to boil the condenser in paraffin as that will remove any air that may have collected between the plates.

You are now ready to construct the containing case for the condenser. This case should be about 1 in. deeper, inside dimension, than the depth of the condenser. The ends and sides of this box can be fastened together in the same way you made the coil case, and should be made of ¾-in. material. The bottom should be of such a size that it will project ¾ to 1 in. beyond the sides and ends of the case. Round off the corners as shown in Fig. 6 and fasten it to the frame with screws from the under side. The top of this case should be made of ⅝-in. material with the edges rounded and fastened to the frame with brass screws. Fasten this piece to the base of the upper case with screws, countersinking their heads. The position of the upper case on its base is shown in Fig. 7. After the holes have all been drilled for mounting the upper case the lower case should be nicely finished to match the upper one.

Mount the condenser in the end of the lower case, Fig. 7. Small blocks of wood can be fastened to the side of the case and the clamps on the condenser fastened to them, thus holding it rigidly in place. The end of the condenser with all the terminals on should be toward the open end of the box. Mount upon the end of the top of the lower case five small switches as shown in Fig. 7. One point on all of these switches should be connected to one line which is to form one terminal of the condenser. The other points of the switches should be connected to the terminals T_1, T_2, T_3, T_4, and T_5 of the condenser. Mount two back-connected binding-posts B_1 and B_2, Fig. 7, and connect the terminal T of the condenser to one of them and the common connection of the switches to the other. You can now vary the capacity between B_1 and B_2 by manipulating the switches S_1, S_2, etc. By placing these binding-posts on the base and connecting your condenser to them you can use the condenser for other purposes than across the contacts of the vibrator. Two other binding-posts, B_3 and B_4, should be mounted beside B_1 and B_2 and they should be connected to the two sides of the vibrator contact. Connecting B_1 and B_3 together and B_2 and B_4 together with a piece of wire you will have the condenser across the contact. Mount two more binding-posts, B_5 and B_6, a little larger than the others as shown in Fig. 7. These are to form the terminals of the primary winding.

A single switching device for the condenser is shown in Fig. 8. The various pieces of brass can be cut from some ⅛-in. sheet brass and fastened to the board with round-headed screws. After they are all in place a tapered reamer can be used in cutting the openings between them. The connections can now be made by inserting small tapered plugs in these openings.

You can get a better variation in your capacity by using the following combination instead of the one given in the first part of the article: First section, 14 sheets; second section, 12 sheets; third section, 10 sheets; fourth section, 8 sheets and the fifth section, 6 sheets. This gives the same total capacity as in the previous case, as the same total number of plates is used.

Cut from some ⅛ or $\frac{3}{16}$-in. brass two pieces whose dimensions corre-

spond to those of Fig. 9, that are to form part of the terminals of the secondary winding. These two pieces should have ¼-in. holes drilled in their centers and tapped. Countersink them in two openings cut in the top of the upper case about 8 in. apart and fasten them in place with two flat-headed brass screws. A piece of ⅛-in. brass about ¾ in. long should be soldered to the under side as shown in Fig. 9. These pieces will project through the under side of the case top and the terminals of the secondary winding can be soldered to them, leaving quite a little slack in the leads. It might be best to make the leads from the coil to these plates of wire insulated to stand a high voltage.

(To be continued)

Making Coins Stick to Wood by Vacuum

Take a quarter and place it flat against a vertical surface of wood such as the side of a bookcase, door facing or door panel, and strike it hard with a downward sliding motion, pressing it against the wood. Take the hand away and the coin will remain on the woodwork. The striking and pressure expel the air between the quarter and the wood, thus forming a vacuum sufficient to hold the coin.

How to Make a Table Mat of Leather

The table mat, the design of which is shown herewith, is to be made of leather. It may be made of Russian calf and the background modeled down as has been described in several previous articles dealing with leather work. To do this the leather is moistened on the back side just enough to make the leather take the impression of the tool, but not enough to make the moisture show through on the face. Any smooth piece of steel, such as a nut pick, that will not cut or scratch the leather and will make a V-shaped depression will do.

A second method is to secure a piece of sheepskin and, using the reverse side, outline the design by means of a pyrographer's outfit. This manner of treating leather is so common that it needs no description.

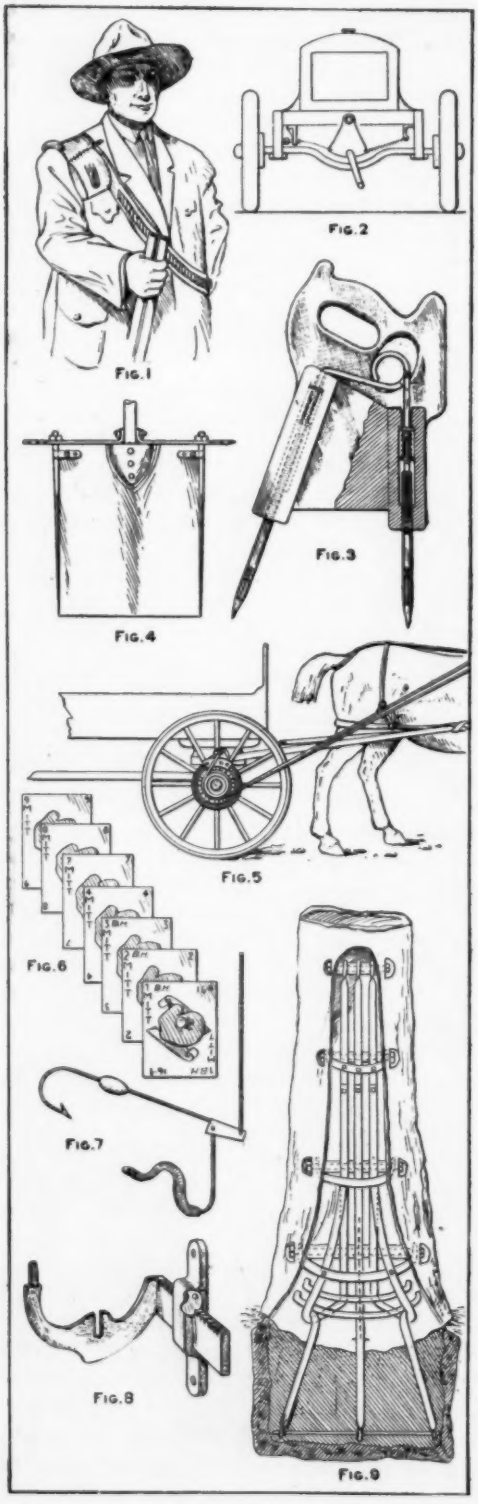
A third method is to secure a piece of sheep or goat skin, trace the design on the reverse side by means of carbon paper, and put the outline and design in with brush and stains such as are sold for this purpose.

The accompanying pattern shows but one-fourth of the mat. Draw the one-fourth on paper to the size desired and then fold on lines A and B, tracing this one-fourth on the other parts by the insertion of double-surfaced carbon paper.

On the calfskin the pattern is to be held on the leather and the tool worked

Pattern for the Table Mat

over the pattern to get the outline transferred. After this the pattern is to be removed and the leather modeled.



INTERESTING PATENTS,

COMBINED CARTRIDGE-BANDOLEER, GUN-REST, AND RECOIL-PAD—This army device (Fig. 1) provides for the carrying of cartridges, as does any bandoleer, and in addition is provided with a recoil-pad for service in firing, and a gun-rest for use in carrying. The gun-rest and recoil-pad are constructed to be detachably connected to either side of the shoulder strap, so that they can be used when the bandoleer is strung over either shoulder.

SAFETY AUTO-CRANK DEVICE—Figure 2 shows a device for automatically securing the starting handle of an automobile in an effective and positive manner. It consists of a device operated or controlled from the speed lever to render the engagement of the starting handle with the engine shaft impossible except when the speed lever is in a neutral or inoperative position. The device is placed in position in front or around the extremity of the engine shaft, connected with the speed lever so that the slot provided in it for the admission of the starting handle assumes a position in alignment with the shaft when the lever is in the position above stated.

HAND-SHOCKING DEVICE—A hand device for shocking grain is illustrated in Fig. 3. It consists of a body portion provided at one end with a hand-hold, pointed tines projecting from the body portion, pivoted fingers carried by the tines, and means operated by the hand-hold for causing the fingers to be projected laterally from the tines in rear of the pointed ends. In the tines are movable rods ending in a ring which sets in a hollow in the hand-hold. In clutching the shocker, one or more fingers engage with this ring and operate the mechanism by pulling it outward, while sets of springs accomplish the opposite movement.

SOD-CUTTING ATTACHMENT FOR SPADES—Figure 4 is a sod-cutting attachment and foot-rest for spades. The manner of attaching it to the spade is shown.

SAFETY LINE-HITCH FOR WAGONS—The moment a horse starts, if this device (Fig. 5) is in operation, the reins wind up and the animal is forcibly brought to a stop. It consists of a cap or band provided with inwardly and outwardly projecting flanges. The reins are passed around the band and made fast to one of the wheel spokes by a double-hook, rein-holding device.

BASEBALL CARD GAME—This drawing (Fig. 6) shows seven cards of one suit of the series of suits into which the cards of a baseball card game are divided. The respective suits bear representations of a catcher's mitt, a baseball diamond, a bat, and a ball. Each suit consists of cards bearing designations indicating a one-base hit, a two-base hit, three-base hit, home run, a fly ball, a catcher, an umpire, a "fan," and a pitcher.

FISH-HOOK THAT SPEARS THE FISH—A fish-hook that catches the fish eating the bait in the body as well as in the mouth is here illustrated (Fig. 7). It consists of a bait hook, a gaff hook hinged to the bait hook, and a buoyant body carried by the gaff hook. The fish makes a dash for the bait, and in doing so pulls the gaff hook downward into its body.

EXTENSION HOOK FOR WINDOW CURTAINS AND SHADES—An extension curtain fixture which will support both lace curtains and shade-roller is illustrated in Fig. 8. The method of extension as well as the means for supporting the shade-roller and curtain pole are clearly shown in the drawing.

PROCESS OF REINFORCING TREES—This patent (Fig. 9) has to do with a method of reinforcing a tree having a cavity in its trunk. It consists of a process of placing the reinforcement in the cavity, securely attaching it to the trunk, and anchoring it to the earth.

PRACTICAL OR UNIQUE

ACETYLENE GAS POP-GUN—This gas pop-gun (Fig. 10) is essentially a gas engine with a cork instead of a piston. Gas is generated in the gun, mixes with the air, and the mixture is exploded by an electric spark exactly as in the gas or gasoline engine. In the gasoline engine, the mixture of air and gasoline vapor is strongly compressed before explosion in order to get sufficient energy to work the piston. In this cannon the acetylene gas is exploded without being compressed and the only effect of the explosion is to propel a light cork and produce a loud noise. Using acetylene, the total amount of inflammable material at each shot is said to be only equivalent to about a quarter of a drop of alcohol or gasoline, and the carbide in the bottle is not inflammable at all, as it must be put into the water before acetylene is produced.

ELECTRIC ICE-SEVERING DEVICE—Figure 11 is a device for severing ice by electrically generated heat. It consists of an angular severing blade of high resistance, and a flexible connection leading to electric supply.

COMB ATTACHMENT FOR HAIR-TINTING—This brush attachment for an ordinary comb (Fig. 12) is designed as a means of evenly tinting the hair. It is provided with spring clips to attach it to the comb. Between the bristles is an absorbent material for the dye.

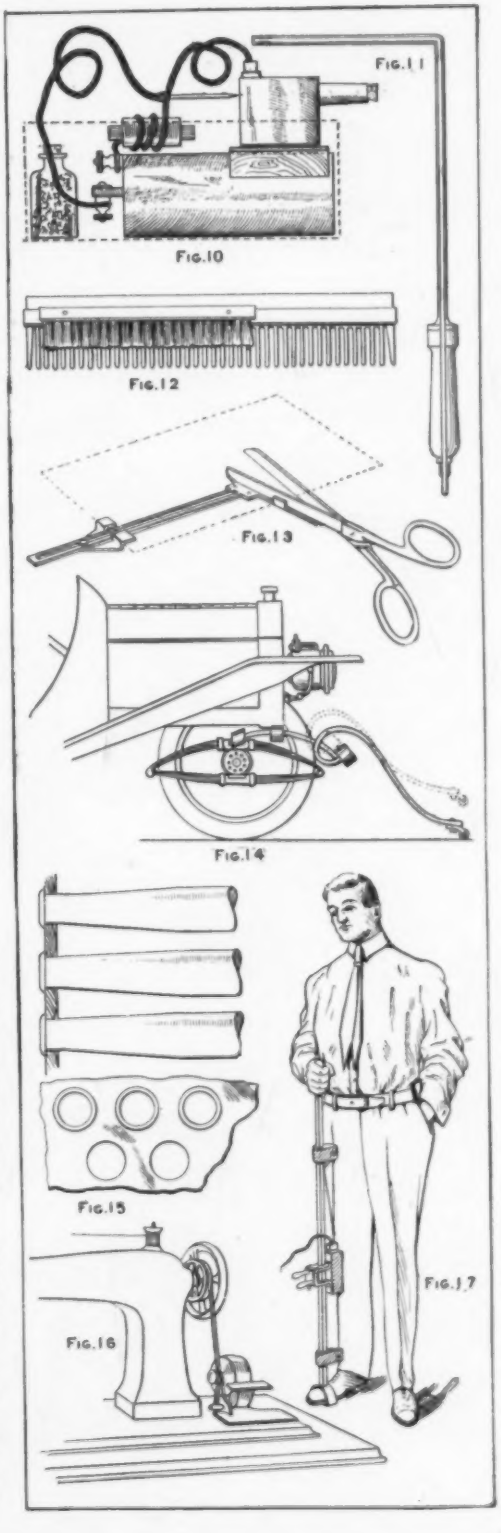
GAGE ATTACHMENT FOR SHEARS—A pair of shears provided with a measuring device is shown in Fig. 13. Its method of adjustment and operation is explained by the drawing. It was designed for cutters of cloth goods.

LIGHTWEIGHT AUTO FENDER—The objection to nearly all fenders proposed for automobiles is due to the awkward and bulky nature of the devices, but this fender (Fig. 14) is, if anything, too far toward the other extreme. The body of the fender consists of two parallel spring slats attached to two spring hangers. The forward ends of the fender are provided with rollers, which engage with the road when the fender is brought into action by striking a person. At other times the fender ends ride a few inches above the roadbed.

SYSTEM OF FLUE-SETTING—A new system of boiler-tube setting, which prevents the erosion and leaking caused by the intense heat in the combustion chamber and on the tube sheets, is shown in Fig. 15. This is accomplished by reducing the section of thickness of metal interposed between the water and the fire. It also consists of swedging or reducing in diameter the ends of the tubes, and by so doing doubles the capacity for water at that point and induces free circulation about the tubes, limiting the expansion caused by the temperature. The reducing of the tube ends at the combustion chamber limits the rapid flow of hot gases through them, but still maintains the heating surfaces by the expansion of the gases as they pass from smaller to larger diameter of the tubes, which means the reduction of stack temperature and cost of fuel.

SCISSORS-SHARPENER—A scissors-sharpening attachment for sewing machines is illustrated in Fig. 16. It is a small grinding wheel mounted in such position on the sewing-machine stand as to be operated by engagement with the belt which drives the sewing machine. Extra belt attachment is in this manner made unnecessary.

PANT-PRESSING DEVICE—This very unique trouser-pressing and creasing apparatus (Fig. 17) is electrically heated. It consists of a support provided with means to engage with the leg of the pant and hold it in the form of a fold, and an electrically-heated creasing and pressing machine, which engages with the trouser fold and is moved up and down the support.



THE smart young man—his school honors thick upon him, and his intention to teach the world in general and his father in particular the manner in which up-to-date commerce should be conducted—stood earnestly holding forth in his father's office.

"You may rely upon me, sir," he was saying, with fervid emphasis. "I will devote my whole life to the interests of the business. It shall be my aim and ambition to keep the family name free from stain."

"Good!" said the old man gruffly. "That's the spirit. Tell the office boy to give you the whiting and ammonia; then go and polish up the brass name plate on the door."—London Mail.

◆ ◆ ◆

Coast Guard—Yes, they raise all their own vegetables on that lighthouse.

Tripper—Dear me! How do they manage to do that?

Coast Guard—With a rope!—Comic Cuts.

◆ ◆ ◆

Prof. Percival Lowell, the eminent Martian astronomer, said in a recent interview in New York:

"The Martian canals are not Panama canals. The word 'canals' you know, really means 'lines.' It shouldn't be taken literally, as the servant girl in Boston took the parlor magic.

"An amateur magician in a Beacon street house was going through his tricks while a maid passed in and out with refreshments.

"The magician was reading letters placed under a rug as the maid brought in a tray of lemon ices.

" 'What letter is this?' a spectator asked.

" 'That is B,' the magician answered, and, sure enough, his answer was correct.

"The maid looked with astonishment at the letter which had been hidden under the trick rug. She turned her gaze on the handsome young magician who had read it. Then, setting down her tray of ices, she hid her rosy face in her hands and ran out of the room.

" 'What's the good o' me clothes?' she cried."

◆ ◆ ◆

"We keep our own cow," explained the hostess, proudly. "So we're sure of our milk."

"Well," interrupted the small son of the guest, setting down his cup, "somebody's stung you with a sour cow."—Cleveland Leader.

◆ ◆ ◆

It was the tiniest of tiny flats.

"Yes, sir," said the maid, "the stork arrived with a fine baby boy."

"Great Josephus!" exclaimed Mr. Flatte, who had been away on a trip. "That means more room. Have you hung the broom in the air shaft?"

"Yes, sir."

"And trimmed the leaves of the rubber plant down to one-half their normal size?"

"Yes, sir."

"Then take the pet dog to the fancier's and have his tail cut off. We must economize room in some way. Thank goodness it wasn't twins."—Chicago News.

◆ ◆ ◆

"What's the matter, dear?" queried Mrs. Owl, as the other half of the family appeared at their hollow tree apartments minus half his feathers. "Been fighting?"

"Not any," growled Mr. Owl in reply. "I got tangled up in a wireless message."—Chicago News.

◆ ◆ ◆

Bob was telling about his visit to the country. While there he had acquired some rustic idioms, and his mother was correcting these as he proceeded.

"Well, we goes up—"

"Went up."

"Went up on the farm—"

"To the farm."

"To the farm, and there we see—"

"We saw."

"We saw a little kid—"

"Little child. Now begin again and tell it properly."

"Well, we went up to the farm, and there we saw a goat's little child."

(Further narration suspended.)

"Brown is the laziest man on record."

"How so?"

"When his wife asks him to water the flower bed in the back garden he throws a bucket of water on his Newfoundland dog and then makes him stand in the middle of the flower bed and shake himself."

◆ ◆ ◆

Orville Wright, at a banquet in Dayton, told of an obstinate old Daytonian who, looking up one still afternoon at the Wright biplanes circling smoothly and steadily through the air, said:

"When people first told me about this here flyin', I called 'em liars. Then, when I read about it in the papers, I said it was a fake."

The old man watched the biplanes moving in great curves like lazy birds, shook his head thoughtfully.

"By crinus!" he said, "I ain't what ye mout call convinced yet, nuther."

◆ ◆ ◆

"What's the trouble?" asked the clerk. "Isn't your room satisfactory?"

"Yes," answered the guest at the big skyscraper hotel, "but I want those clouds pushed away from my windows."—Hotel World.

◆ ◆ ◆

"See that measuring worm crawling up my skirt?" cried Mrs. Bjenks. "That's a sign I'm going to have a new dress."

"Well, let him make it for you," growled Mr. Bjenks. "And while he's about it, have him send a hookworm to do you up the back. I'm tired of the job!"

◆ ◆ ◆

The telephone girl had married well, and was stopping at a hotel with her husband. Rising at 10 a. m., she rang the bell for the servant.

"Why didn't you wake me up, as I instructed you?" she asked.

"I did, ma'am," answered the slavey, "but when I said, 'Seven-thirty,' you replied, 'Line busy. Will call you up.' "—Lippincott's.

◆ ◆ ◆

Old Lady—Well, my boy, and what do you want?

Boy—I've called for the reward of five shillin's wot you offered for the return of your canary.

Old Lady—But that is a cat you have there!

Boy—Yes, I know, mum; but the canary's inside of 'im. I just seen 'im eat it."—The Tatler.

◆ ◆ ◆

"John! John!"

"Huh-wha-what is it?"

"There's a burglar in the house!"

"All right, I'll get out and look for him."

"John—John! Oh, where are you?"

"Whatye want?"

"I hear the burglar under the bed."

"Hush! that ain't the burglar, that's me."—Houston Post.

◆ ◆ ◆

"What are you doing with those field glasses?" asked the mother.

"Oh," said the daughter, as she turned her gaze skyward again, "I am looking for Jack; he said he would be down this evening."—Life.

◆ ◆ ◆

"Pardon me, madam, but the way that man across the aisle is staring at you must be very offensive. Do you wish me to interfere?"

"Oh, no, thank you. That's my husband."

"Your husband!"

"Yes. He's very nearsighted and thinks I'm somebody else."

◆ ◆ ◆

Professor—Jones, will you differentiate between the words "discover" and "invent?"

Jones—Well—er—Peary discovered the pole and Cook invented it.—Dartmouth Jack-o-Lantern.

◆ ◆ ◆

Warden—No'm the guy that killed his family ain't here no more. The Gov'nor pardoned him.

The Visitor—What a shame! I've brought him a lot of roses! What other murderers have you?

—Cleveland Leader.